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A Description of the Kerite Wire and Cable Works at Seymour, Conn.

In this issue we give an illustration showing the factory of Mr. A. G. Day, at Seymour, Conn.

In the south end of this building the first process of constructing a properly insulated electric-light, telephone, or telegraph wire begins.

To make the crude kerite, the ingredients which enter into its composition are thoroughly mixed together and put into boilers, and allowed to stand until "done." The composition when hot is about the consistency of thick molasses, and is run into cakes or layers, and in cooling becomes very much like soft rubber gum. These layers are piled up with a slight separation of soapstone to prevent their sticking and to enable the workmen to handle readily. Pure Para gum only is used by this house in making this insulating compound, and is carefully selected and cleaned by a machine which separates the fibre and washes out all the impurities.

This latter process is the invention of Mr. Day, and was first used by him in 1852.

The cleansed gum and crude kerite is then thoroughly mixed together by the usual grinding operation, after which the composition is strained to take out the smallest particles of dirt or other foreign substance that might interfere with perfect insulation. The composition is now ready to be placed upon the wire, and is cut into strips about an inch square and fed into an ingenious machine that covers it upon the wire as it passes through at a moderate speed, coming out of this machine with a perfect deposit of soft composition distributed equally over its surface. The wire is coiled in layers upon large receiving pans about ten feet in diameter. Each coil and layer is again separated with fine soapstone dust to prevent adhesion, and also to hold it in position during the vulcanizing process. These pans, after being filled, are hoisted by cranes into immense heaters, holding eight pans, and the "cooking" process goes on for about three and a half hours, the temperature reaching nearly 300 degrees Fahr. The coils are allowed to cool gradually, and afterward re-wound upon medium sized spools or "testing reels," and are placed in a large tank and submerged in water for at least forty-eight hours. The wire now has the compound firmly upon its surface, and to make certain that no faulty workmanship, or stray particle of non-insulating material has found its way into the composition, and made imperfect insulation, it must be tested carefully and thoroughly.

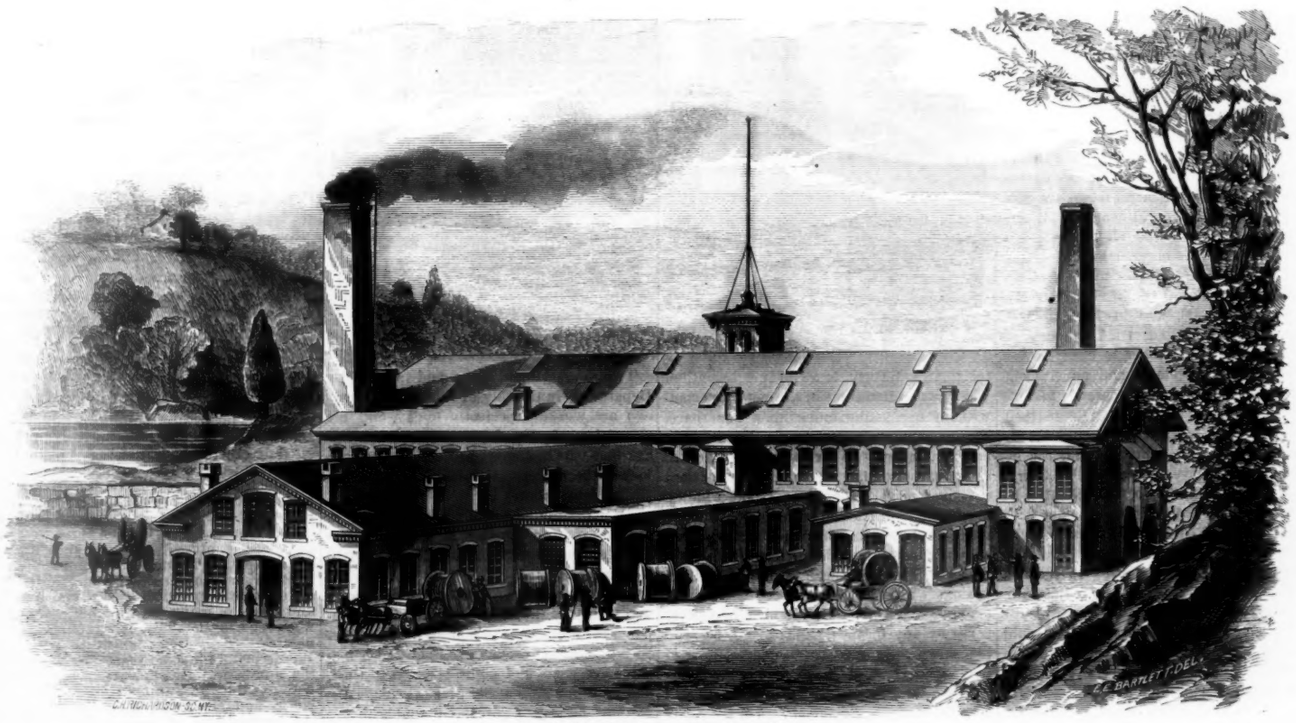
This delicate and essential part of the work Mr. Brixey, superintendent of the factory, attends to personally. The tests are made upon a Thompson's "dead-beat" galvanometer of 100 chloride of silver cells, and while the wire is in the bath—and not a foot of wire has ever gone out of this factory without an exhaustive test of this character being made and perfect insulation found. That portion of the wire that will be used for single lines is taken at this point, re-wound and boxed, ready for shipment. All the rest is made into cables, and goes from the tank upon spools for the cable-making machines. This is an important operation, and must be done perfectly to get good results. The machinery used for this purpose is made in various sizes, and will lay up cables containing from one to sixty strands, and are models of perfection.

Aerial and underground cables are then covered with a water-proof tape, making a compact, immovable cable, and are reeled up in lengths as required, ready for shipment. The submarine cables have a coating of prepared tape over each strand; are then taken from the "laying-up" machines and a heavy coating of jute fibre wound upon them as a protection, and also to make a cushion for the armor to rest against without injury to the insulation. An armor of the best "B B." galvanized iron wire is now placed upon the cable, and forms a complete outside protection.

Careful attention is given to each stage; from the first, when the crude kerite forms itself into an indestructible quantity, to the winding of the cables, completed in every detail, upon the immense reels. The difficulties of the task are innumerable, and are met and conquered only by intelligent and trained men.

Each length of wire must be straightened to secure an equal distribution of insulating compound, and carefully tinned to prevent chemical action taking place, after years of constant use. The preparation of the insulating compound and its application, and finally the mechanical winding of the separate strands into the cables, presents a problem not easily grasped by those not familiar with this essential branch of the electrical business of our age.

To arrive at this state of perfection a vast amount of labor has been expended. Years of experimenting, through almost the whole field of chemistry, sleepless nights chasing some scientific theories to the utmost limit of thought only to find it by experiment a fallacy. The discovery of the secret at last, and its practical application for the benefit of mankind, are some of the experiences of the inventor, Mr. A. G. Day.



A. G. DAY'S WIRE WORKS, SEYMOUR, CONN.

In 1850, after several years' experience in the experimental and other departments of Charles Goodyear's factories, Mr. Day began to carry forward experiments of his own. Entering a new field of discoveries, he by diligent application of mind and body soon solved one of the most important commercial problems of that age. Hitherto rubber had been made only into two forms—one the extremely flexible of that day, the other hard, brittle substance that broke like glass. Mr Day's discovery consisted in combining elements with long-continued heat that gave as a product the hard, flexible "whalebone" rubber almost in its entirety as used to-day. This process was patented in 1858. In 1858 Mr. Day discovered and applied a new process for cleaning india-rubber, which he perfected and patented in 1856.

The cleaning and purifying of commercia india-rubber was preparatory to perfectin

the hard-rubber process. Up to that time only one quality of rubber was used—Para rubber from Brazil—the qualities from all other parts of the world being filled with too many impurities to be of practical value. The supply of Para rubber was too small for the market and the price far too high; but the demand called for the using of these impure qualities. Mr. Day's cleaning process gave confidence to the importers that these impure qualities could be used; and this fact being established, more than double the quantity was imported, which reduced the cost one-half. The result was the bringing into use of rubber from other parts of the world—Africa, the East Indies and Central America. The importance of the improvement was apparent; it more than doubled the supply.

In 1854 Mr. Day bought a factory at Seymour, Conn., for developing the cleaning process, and to perfect his hard rubber patent, with space for carrying out future inventions.

The factory now occupied, and of which we give an illustration, was erected on the site of the older wooden structure, burned down eighteen years ago, and has a floor space of about 50,000 square feet. It has two full stories, where the major part of the work is done, and an attic, used for a drying and storeroom.

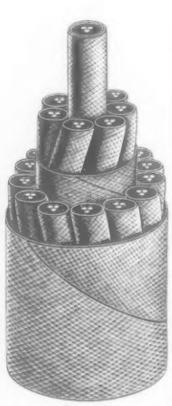
Mr. Day, while in New Haven, had begun to manufacture hard-rubber pencils and penholders, and he continued it at Seymour, with the distinct object of making it a business while making his improvements. The manufacture of these goods is carried on in the second story of the present factory, and is under the management of Mr. Day's brothers, who devote their whole time and entire attention to this interesting industry.

Without the cleaning process, hard rubber could be manufactured only from Para rubber. East India and Africa rubber sold from 12 to 15 cents a pound in 1853, while Para rubber brought from 30 to 40. Before the cleaning process had gone into general use, Para rubber had advanced from 75 cents to $1, and would have risen to $1.50 This made it a necessity to use the cheaper qualities, and from 1855 to 1864 these qualities had advanced from 12 to 70 cents. In 1853 Mr. Day cleaned 55,000, and in 1859 500,000. Manufacturers had long tried to combine other materials with rubber to cheapen and improve it, and vegetable and mineral oils and coal-tar had been used separately to some extent. In using these materials in their natural state, combined with rubber, the compound became too adhesive, and the ingredients had to be worked separately. Carrying his investigations into this field also, he conducted a long series of experiments with the sole object of overcoming this obstacle, and producing a compound that could be combined with rubber, resulting in the discovery and invention of the valuable substance known as crude kerite, as a substitute for caoutchouc, and making a product that could be worked on machinery. Returning to Seymour, he prosecuted his experiments with still greater assiduity and success. He made his first application of kerite to the insulation of telegraph wire, this giving it the severest tests by exposure to air, earth and water, and has continued it to the present time, applying it to all kinds of insulated wire and cables.

During 1867, 1868 and 1869 he was making from 1,000 to 3,000 experiments a year, and had tabulated 350 formulas for making crude kerite. These experiments involved the whole range of the use of vegetable and mineral oils, bituminous gums and resins, in combination with sulphur, acids, alkalies, earth and mineral oxides. By constant exposure to the gases of these combinations, and unwearied experiments for five years, he became physically exhausted, which resulted in severe illness that confined him to his room for six months. After his recovery he went to Europe, where he remained two years. There he observed the condition of the art of manipulating india-rubber, and particularly the insulation of telegraph wires and cables, with their manufacture. He returned home in April, 1872, with restored health and a better knowledge of the imperfections and wants of insulated wires and cables, as well as the needed improvements in his crude kerite and its combination with rubber. He now commenced a new period of activity and development. The crude kerite is composed of many different substances. It may be combined with india-rubber, sulphur and oxides of metals in the usual way known to manufacturers. It is then prepared for coating telegraph wire, or as applied to the manufacture of all other articles of india-rubber goods. This crude kerite is a raw material, giving more durable and valuable qualities to india-rubber manufacture, as well as reducing its cost, and is capable of application to the whole rubber business. Its combination, application and perfection have been the result of immense labor and experience, commencing with 1841, and has been the definite object of Mr. Day's labor since 1865, and he has devoted to it more of time and thought than to all his other improvements.

After the discovery was made by Mr. Day, it was necessary to apply mechanical arts to properly develop this industry economically. To do this necessitated the invention of machinery to properly handle the large product demanded. Mr. A. G. De Wolfe, a competent mechanical engineer, was the man whom Mr. Day selected to take charge of this department, and the machinery employed in

No. 1.



No. 2.

their large factory is all of his invention. We may mention some of the most important without trespassing much upon our space. The cable-winding machines of various types, five in number—two for putting the "kerite" compound upon the wire, the jute and armor covering, and various bobbins or spool-winding machines, with friction adjustments, and an ingenious measuring machine, which accurately marks off the miles or feet of wire as it passes between its rollers. Our smaller illustrations will show several sections of cable made by Mr. Day. The number or variety is not by any means complete, and the sample shown will give but a general idea of the magnitude of the work done in Seymour.

The section of cable, marked No. 1, will give the reader a very good idea of the excellent workmanship with which every stage in its construction has been performed, and shows a telephone, aerial or underground cable containing sixty-two conductors. No. 2 is an underground telegraph cable, waterproof covering applied and ready for use.

No. 3 is a seven-strand submarine cable showing the spirally-wound copper wire conductors, the jute packing, and armor over the whole.

A cable of this character has been in use by the Baltimore and Ohio Telegraph Company between Philadelphia and Camden, under the Delaware River, for some years, and from long contact with the anchors of vessels the armoring has been completely torn off for nearly its entire length. Notwithstanding this fact, there is no interruption in the service from induction or other causes.

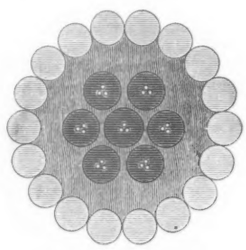
No. 4 is a half-size view of electric light wires with kerite insulation, and in addition the usual braided fire and waterproof covering on the surface.

In No. 5 is shown the conductors in use for electric light purposes on the New York and Brooklyn Bridge, and differ from their standard only in one particular—larger copper wire and heavier insulation is used.

Mr. Clark B. Hotchkiss is the agent and business manager for Mr. Day. His untiring energy and exact business principles are too well and favorably known to require comment from us.

The first Anti Induction Telephone Cable was made for the Metropolitan Telephone Company of this make, in June, 1881, and since then they have made many miles of cable for the same company. They have also made cables of the same kind for Chicago, St. Louis, Cincinnati, Pittsburgh, Boston and Montreal, all of which have given satisfaction.

The Gold and Stock Telegraph Company, and the Western Union Company in this city have had in various use cables from 8 to 10 years—some of them being even 12 years old—and we have yet to learn of any complaint against them as to their perfect working, and we know of no expense that the companies have been to for maintenance. The cables have also been in use by the Western Union Company for 8 or 10 years throughout the United States.



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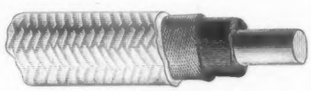
No. 4.



No. 5.

Two underground wires laid for the Fire Department in the City of Chicago 8 years ago are working perfectly to-day, and the electrician of that department said months ago that "he had never had occasion to even look at the wire—that it had always given perfect satisfaction."

An underground has been buried and in constant use for the last 11 years at Vassar College, Poughkeepsie, N. Y., and is still working perfectly.

An underground wire made by this process was furnished the Brush Electric Light Company, of Baltimore, 18 months ago, and has been in constant use on a 40-light Brush machine every day and night since that time, and up to the present has given perfect satisfaction—no leakage, break, or trouble having taken place on same.

Many miles of their submarine cable have been in use for the last 8 years, and have always given satisfaction.

Sawyer & Mann to have Sole Use of Carbonized Paper in Electric Lamps.

WASHINGTON, Oct. 8.—A decision was rendered to-day by the Commissioner of Patents in the interference case of Sawyer & Mann against Thomas A. Edison, which involves the question of priority in the invention of "an incandescent conductor for an electric lamp formed of carbonized paper." The Commissioner awards the patent to Sawyer & Mann, and in so doing reverses the decision of the Board of Examiners-in-Chief made on July 28, 1883, by which priority was awarded to Edison.

Commissioner Marble is of opinion that the conductor of which Edison claims to have been the inventor and the Sawyer & Mann conductor are substantially the same, and that the testimony shows that Sawyer & Mann had the conductor in a rude form in March, 1878, and in a perfected form in September or October, 1878, while Edison did not have his conductor perfected until October, 1879.

This decision only affects Edison's right to a patent for an incandescent conductor made of carbonized paper. He already holds patents for such conductors made of carbonized bamboo, willow, and other substances which, it is said, he uses in nine out of ten of the lamps made by him. A decision in his favor would, however, have secured to him the entire control of the manufacture of carbonized conductors, as paper is the only substance of which such conductors are at present made that is not covered by his patents.

The decision of the Commission is final as far as the Patent Office is concerned, but an appeal to the Secretary of the Interior is yet open, and should the Secretary affirm the Commissioners' decision, Mr. Edison may file a bill in equity to compel the issuance of a patent to him in the United States Circuit Court, and thus bring the question before the legal tribunals.

Obituary.

Last week it was our sorrowful duty to have to record the decease of that eminent electrician, Mr. C. F. Varley, and it is now with extreme regret we announce that on Saturday last another well-known electrical engineer, Mr. R. Werdermann, was suddenly snatched by the hands of death from the ranks of science at the comparatively early age of fifty-five years. The deceased gentleman had been resident in London since the year 1870, when he brought over from Paris, and introduced into England, the "Gramme" dynamo-electric machine. Notwithstanding his long connection with the invention of M. Gramme, and the enthusiastic manner in which he championed this most successful machine of modern times, we understand that he sustained heavy losses in his business associations therewith. The recent decision of Judge Blatchford in America, declaring the Gramme patent void, was, we believe, a most serious and heavy blow to him, as we are informed that he owned the American patent. In 1878 Mr. Werdermann's name was most prominently brought forward in connection with his so-called semi-incandescent electric light. We published at the time full particulars of his lamp, which doubtless gave a great impetus to electric lighting in England, and which has since been successfully imitated by other electricians.

The subjects we have mentioned are those by which Mr. Werdermann is best known, but the records of the Patent Office show very forcibly his great energy in other directions. For the past two or three years he had busied himself in perfecting a new dynamo and an incandescent lamp, referred to at various times in our columns. He was an eminently practical electrician, and his knowledge of many other branches of science was very considerable. It was our lot to be in almost daily communication with Mr. Werdermann for some years, and to assist in the numberless experiments which he made with dynamos of various constructions, arc lamps and electric candles, electro-plating, the transmission of power by electricity, which is now attracting so much attention at home and abroad, electrical railways, and many other minor matters in which electricity played the leading part.

The results of these experiments will probably never be known to the world, but from our own experience we can truly say that many things which are now in successful operation were fully worked out by Mr. Werdermann in the early days of dynamos. His inventive mind led him to attempt too many things, the result being that before one subject had been fairly started towards a successful career it was abandoned for another. Like many others who have labored towards the advancement of science, it is to be feared that he has left his family, consisting of the widow, a son and three daughters, without any provision for the future. Space will not permit us to dwell upon the many admirable personal qualities possessed by Mr. Werdermann. An affectionate father, and a staunch friend to those who possessed his confidence, he will be kindly remembered by those who gained his esteem.

We look back with satisfaction that in former days we were enabled to render him such assistance as laid in our power, but it is much to be regretted that his long and laborious toiling has been so ill-rewarded.—*London Electrical Review.*

THE HARRIS-CORLISS ENGINE.

An Engine which Combines Smoothness of Movement with Economy of Fuel.

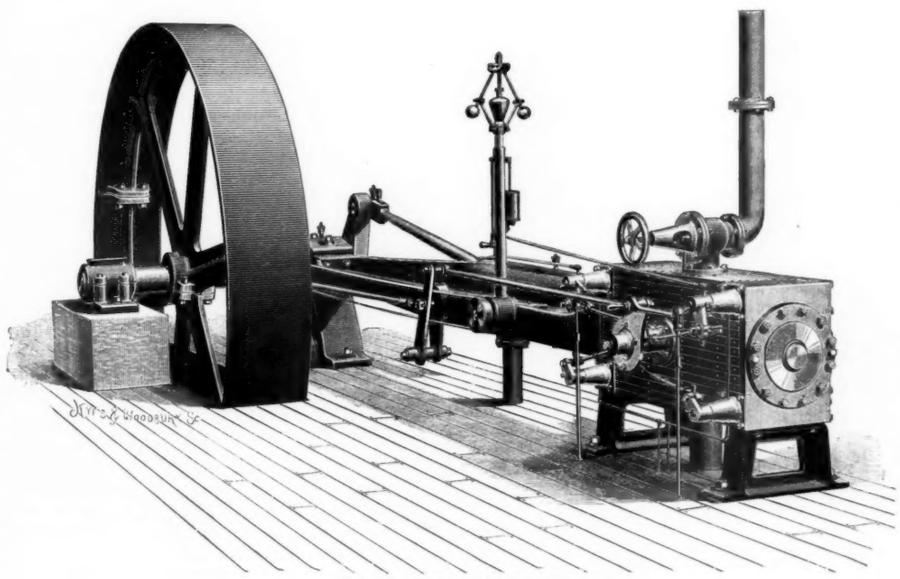
EXPIRATION OF THE CORLISS PATENTS IN 1870 LEADS TO THE IMPROVEMENT OF THE ENGINE — MECHANICAL CONSTRUCTION — ACCESSIBILITY OF ALL ITS PARTS—REGULARITY OF SPEED—THE WORK IT IS CAPABLE OF DOING—ITS FITNESS FOR COUPLING WITH ELECTRICAL GENERATORS — ITS POWER AND RELIABILITY.

In the establishment of an electric lighting plant nothing is of more importance than the steam-engine which is to work the generator. Smoothness of movement is an absolute necessity in any engine that is to be coupled to the dynamo, and where an engine is employed which does not possess this quality the most unsatisfactory results are likely to come of any attempts at general illumination. This quality of smoothness in running is extremely rare, and it is, therefore, with no little pleasure that when we discover engines which possess it, we bring them to the notice of those who are, or who in the future are likely to be, in need of them.

The Corliss engine is so well known as to need no word of commendation from us. It is known all over the world, and has successfully stood a test which the owners of few devices for collecting the power of coal can claim. The Corliss patents expiring in 1870, Mr. W. A. Harris, an expert mechanical engineer with the experience of nearly a quarter of a century, added several important improvements to the Corliss engine, and now manufactures what has become well known as the Harris-Corliss engine.

In constructing this engine Mr. Harris has followed systematic rules of proportion of one part to another part, a proportion much heavier than usual, from drawings which have been prepared with much care and study.

The small parts of this engine are interchangeable, and are kept in stock or sent to any part of the country on demand. This, as may well be supposed, is a very important feature, for it enables those using the Harris-Corliss engine to receive immediately by express such parts as may have shown a defect after long usage.



THE HARRIS-CORLISS ENGINE.

The advantages of this engine may be thus summed up:

Economy of fuel, oil, wear of engine and boilers, grate-bars, pumps, furnaces, reduction of boiler pressure; the amount of work it is capable of doing; regularity of speed under varying loads and steam pressure; accessibility of all its parts; no part of regulating medium operates through stuffing-boxes or in any manner as an actuating medium of the whole motion; no part of the regulating medium enters the steam-chest, and is not, therefore, subject to the corrosive action of steam and the oil used for lubricating the valves and piston.

The Harris-Corliss engine has patent self-packing valve stems, dispensing with the use of the old style of stuffing-boxes and hemp packing.

The shafts are of hammered wrought-iron, the bearings in length being very near equal to diameter of cylinder, and in diameter one-half the diameter of cylinder. There is a stop-motion on regulator of engine, which effectually stops the engine whenever the regulator by any means fails to perform its office, preventing the engine from running away. There are recessed valve-seats, which avoid the necessity of wearing shoulders on them.

As said before, smoothness of movement is an absolute essential in a steam-engine which is to be used as an adjunct to the electric light, but economy is another quality that is hardly less a necessary quality, and that engine which shall more completely combine these two virtues will best commend itself to the projectors of electric-lighting installations.

This being the case, we desire to have a word to say regarding the economy of the Harris-Corliss engine. The mere assertion that this or any other engine was very economical would, naturally enough, be of little importance, nor is it just to other similar designs to make a general statement without producing proof in support of the assertion In this case the proof is at hand, and instead of asserting the claims of the Harris-Corliss engine, we will simply lay the evidence before our readers.

The experts' report of the competitive trials of automatic cut-off engines at the Fair of the American Institute, October, 1869, showed the percentage of gain in economy in the Harris-Corliss engine as compared with its single competition was 26 per cent., or with the same expense in fuel the Harris-Corliss engine developed 35 per cent. more work. In the competitive trials at the Cincinnati Industrial Exposition of 1874, by the experts' report on the performance of automatic cut-off engines the gain in economy of the Harris-Corliss engine as compared with its competitor was 10.5 per cent., or with the same expenditure of fuel this engine developed 11.5 more work. In the competitive trials at the Cincinnati Industrial Exposition for 1875, by the reports of the experts on the performance of automatic cut-off engines the gain in economy for the Harris Corliss engine as compared with its competitor was 7.5 per cent., or with the same expense of fuel the Harris-Corliss engine developed over 8 per cent. more work.

Probably the most convincing proof of the economy of the Harris-Corliss engine is the record of the trials made at the works of the Meriden-Britannia Co., September, 1868, the competing engine being an automatic cut-off engine of the same class. The expense of fuel was measured by weighing the coal burned under the boilers and the efficiency of engine based upon the number of plates rolled. The Harris-Corliss engine rolled 1,532 plates with a consumption of 18.875 pounds of coal, while the competing engine rolled 700 plates upon a consumption of 21,635 pounds of coal. The Harris-Corliss rolled 46 per cent. more plates per day with a consumption of 4.184 per cent. less fuel, hence the Harris-Corliss engine showed a saving of 60 per cent. in cost of power.

An electric light car has been built by the Cumberland Valley Railroad Co. It will be used to supply electric light to picnic grounds along the line of the road.

Conversion of Light into Electricity.

The production of light from electricity is so well known that it may have seemed singular that light would not generate electricity. The latter has actually been accomplished by Sauer, who has constructed a battery that acts only in sunlight. In this case it is the chemical constituent of the light that furnishes the power. Heat rays acting upon a thermo pile also produce a current.

Sauer's battery consists of a glass vessel containing a solution of fifteen parts of table salt, and seven parts of sulphate of copper in one hundred and six parts of water. Within is a porous cell containing mercury. One electrode is made of platinum, and is put in the mercury; the other is of sulphide of silver and is placed in the solution. Both are connected with a galvanometer, and the whole is inclosed in a box, when not in use. When the battery is placed in the sunlight, the galvanometer needle is deflected to a certain point and the sulphide of silver is found to be the negative pole. Any change in the intensity of the light, such as a cloud over the sun, is indicated by the needle. The action of the battery depends on the effect of the chloride of copper upon the mercury. Subchloride is formed and reduces the sulphide of silver, but this can only take place with the aid of sunlight.

Hitherto the only manner in which light seemed to affect electrical action was by increasing the resistance of a selenium cell, and all photo-electrical experiments were based on this phenomenon.

Sauer's battery will be found described in the *Electro-technische Zeitshrift*.

A carbon for electric lighting purposes is thus prepared by M. Jacquelain so as to remove all the impurities from it. Gas carbon is subjected (1) to treatment with dry chlorine at a red heat for thirty hours; (2) to treatment with hot alkali for about three hours; (3) to immersion in hydrofluoric acid (one to two of water) at a temperature of 15° to 25°, and (4) to the action of the vapor of a highly boiling hydro-carbon.

An Electric Counter.

M. J. Cauderay has devised an electric counter or coulomb meter, which is exceedingly simple. It consists of a cylinder turning by clockwork at the rate of one turn per second. The cylinder is furnished with teeth like the barrel of a musical box, and arranged in circles at equal distances from each other. The middle circle, which divides the cylinder into two equal parts, has no teeth. On each of the circles next it there is one tooth; on those next that again, two teeth; on those next that again, three teeth, and so on. The needle of a suitable ampere meter or ammeter is adjusted so that its zero position brings it tangential to the middle circle on the barrel. When, however, a current of one ampere flows through the ammeter, the needle is deflected to the first circle, and there the first tooth striking it works a counting apparatus. As the barrel rotates once per second, and the first circle has only one tooth, the counter records the number of coulombs. Similarly, when the current is two amperes strong, the needle is tangential to the second circle, and is acted only by two teeth, thus giving the number of coulombs also.—*Engineering, London.*

On the 25th ult. the *juiz de direito* of 2ª. *vara commercial* of this city rendered an important decision in an action brought by the Telephone Co. against the president and directors of the Companhia Nacional de Electricidade in the matter of recently issued patents of the Bell telephone inventions. He held that as the Bell telephones have been known and used in this city since 1877 no patents can now be issued upon them, and that those granted, therefore, are null and void. He also condemned the methods employed to secure these patents as irregular, and charged the president of the Companhia Nacional with acting in bad faith. He thereupon declared the patents null, and condemned the defendants to pay all damages and costs. This sentence can not be otherwise than highly satisfactory to the public at large on the grounds already taken in these columns. We have before called attention to the manifest irregularities connected with the organization of this Companhia Nacional, and with the subsequent effort to sieze the telephones imported by the old company.—*Rio News.*

Since the evening of the 23rd ult. a successful experiment in electric illumination has been in operation at the Largo do Machado under the direction of the representatives of the United States Electric Lighting Co. and Mr. Charles B. Raub, electrician. Ten Weston lights of 2,000 candle power each, have been employed, and with results never before witnessed in this city. The dynamo is stationed in the Botanical Garden Co's building, where it has been visited by the Emperor and a large number of people. Thus far the lights have burned steadily and without the least interruption, thus demonstrating their great value as a means of public illumination. We understand that a company is being organized for the introduction of this light into Brazil.—*Rio News.*

The City Council of Montgomery, Ala., have decided to light the city by electricity, and will place twenty-three lights at the intersections of streets. The light will be turned on November 1.

Evaporation and Electricity.

Dr. L. J. Blake has been investigating the statements of Pouillet and others to the effect that electricity is produced by the simple evaporation of a liquid. He worked with sea water, sulphate of copper solution, chloride of sodium solution, etc., but in every case the results went to show that electricity is not produced in this way, and that some other means must be found of explaining the production of atmospheric electricity. Dr. Blake also negatives the hypothesis of Franklin and others to the effect that electricity is conveyed by still evaporation from an electrified liquid. The experiments were conducted with a quadrant electrometer of M. Voss, Berlin.—*Engineering, London.*

(Correspondence.)

Stored Electricity in Mills.

A SUCCESSFUL EXHIBIT BY THE BRUSH-SWAN COMPANY IN WILLIMANTIC—A CHEAPER AND A BETTER LIGHT THAN GAS.

On Wednesday evening last, the Brush Swan people, through the courtesy of the Willimantic Thread Company, were able to give the first public exhibition on this continent of the practical use of stored electricity for mill lighting purposes. Between two and three hundred people came from New York, New Jersey and all parts of New England to see what they could do. There were men present (electricians they have been called), who had given their opinions orally and in print, while admitting that the storage battery had in it the germ of a grand discovery, that its economical use for everyday purposes was as yet a long way in the future. They probably went away wiser than they came. But the men who kept their eyes and ears opened, and put questions to the Brush representatives that hit the bull's-eye every time, were the cool, practical, economincal mill owners and mill agents (most of them from this State, but many of them from others) who have been patiently waiting for years for some relief from gas illumination. If the success of the exhibition is to be gauged by what these men say, and what has been reflected of their opinions in the local press, then the inventors of the system are to be congratulated Among the guests were Prof. Charles R. Cross of the School of Technology, Boston, Lieutenant Commander Bradford of the U. S. S. Trenton, and Lieutenant Coudon of the Naval Ordnance Department Messrs. Thos. J. and William J. Montgomery received the visitors on behalf of the Brush Company.

The Willimantic Thread Company is one of the largest and most widely-known manufacturing concerns in New England. Its goods are shipped to all parts of the globe. It has won a national reputation for its readiness to encourage all modern inventions that will add to the comfort and improve the condition of its employes, wisely concluding that for first-class work, good help and good tools are essential. Railroad passengers from Boston and Providence that go whirling past its large mills are impressed at once with the cleanliness and good order of their appearance, and listen with interest to the plan for the moral improvement and welfare of its sixteen hundred operatives. It is a fortune for the Brush people to have the cordial endorsement of such a prosperous company.

Even a passing glance at what the party saw as they were taken through the immense operating room and inspected the wonderful labor-saving machinery, the powerful engines and the huge boilers, would be out of place in this article. But as the Willimantic Company were among the pioneers of electric lighting in this State, an idea of what they have grown to in this respect may prove of interest.

The company began to experiment with a Brush arc light in 1878. It did not long remain an experiment, for when they put up their big new mill (50,000 spindles, all on one floor,) it was built especially for the arc lights, all the belting being run underneath the floor. They did not put in a single gas burner, to the great consternation of the local gas company, who had calculated on fully 1,500. Their action was followed by an almost immediate reduction in gas. It is policy for the company to use the arc light in this mill rather than the incandescent. It is a cheaper and brighter light, though not so well diffused. With an arc light they can get a 2,000 candle lamp to the horse power, while they are only able to get eight incandescent lamps of sixteen candle-power to the horse-power.

But there is a great disadvantage in using the arc light in mills when the shafts and belting are suspended from the ceiling. It is impossible to prevent great shadows from falling on the looms, seriously hindering the operatives at their work. The Willimantic Company still used the gas in their old mill, and awaited the perfection of the Brush storage battery. They got a little tired of waiting, and wanted to put in the incandescence lamp with power direct from the dynamo, but the Brush people would not consent. They did not want to furnish the incandescent light except through the batteries. So last year the company put in a sixty-light Edison plant in the winding room of No. 2 mill (the second largest) getting the power to run the dynamo from the mill engine. And right here they found that the Edison light was not going to answer them. Sometimes it is necessary to stop the entire machinery in the mill for a few minutes to make an adjustment. When the machinery stopped the lights went out and the operatives were in total darkness until it was set in motion again. About five weeks ago they put four Brush storage batteries on the floor of the carding room of No. 2 mill, and began experimenting with more than 250 lamps. Their success was beyond their anticipation, for they found that they could put in six or eight batteries without an increase of power. The main offices, reading rooms, library, president's office and co-operative stores, besides the mill, are now lighted from the batteries already put in. They have thrown out 500 gas burners all told.

The house where the dynamos are located is some 300 or 400 yards away from the mill. It contains two dynamos. One, a No. 8 machine, furnishes the power for 40 arc lamps in the big mill, and also does a share of charging the batteries while the arc lamps are not in use. The other is a sixteen light No. 7 Brush dynamo, absorbing twelve horse-power, giving out 18 amperes and 400 volts e. m. f. This charges six secondary batteries capable of feeding 350 lamps, or even more. They get their power from water that has heretofore run over the dam and been so much waste. Thus they get their light for simply the wear and tear of the machinery and the interest of the investment. By a calculation made two or three years ago it used to cost $13.80 an hour to furnish gas for No. 2 mill alone. Of course they have to burn a little there, now, but the gas jets are rapidly dwindling away, and will soon disappear entirely, no doubt.

The loss in the batteries is said to be only from fifteen to twenty per cent. The lamps run (fourteen) to an electrical horse-power, and eight, or sometimes ten, to the indicator horse-power. It takes from seven to eight hours to store the batteries—provided they are empty at the start, a thing which does not often occur—and they furnish a brilliant, steady light for nearly four hours. The lamps require thirty-eight volts electromotive force, and the current is $1\frac{5}{10}$ amperes per lamp. The lamps last, on average, 1,000 hours continuously, and the Brush Electric Company guarantee that the batteries will increase in efficiency during the first year and not cost more than 5 per cent. per annum to maintain them at their full efficiency. They claim to furnish a more economical light than the Edison, and a brighter and better one.

The batteries were filled and the dynamos had ceased running for some time before it was dark enough to light the mill. The visitors were grouped about the queer-shaped boxes containing the lead and sulphuric acid watching the busy operatives at work. The superintendent stepped to the desk and touched a button and two hundred shining little globes made the room as bright as day. The colors of the thread could be matched as well as in the sunlight. The lamps burned steady and unwavering, and the air was sweet and cool. So different from the hot, vitiated atmosphere of a large room heated by gas, with imperfect means of ventilation. I mentioned this to the superintendent, whom I was talking with.

"The room has been like a different place since we have been running them," he said, "and the girls are happier and work the better for it."

"Then you like the light better than gas?"

"Oh, there's no comparison, and besides it is much more economical."

Down-stairs, in the winding-room, the Edison lamps were burning away brightly, but with a more subdued light than the other. Some people prefer it for the eyes. When the bell rang to shut down, I went into the Edison room. The shafting began to creak, the great engine came to a standstill, and the girls were pouring out in a living stream through the door, some of them putting on their garments as they went In less than two minutes the room was in total darkness and deserted.

Up-stairs the Brush lamps were burning brightly from the force furnished by the batteries. The operatives took their time and lingered to look at the glittering rows of lamps when the hum of the wheels was hushed and the looms vacant. The electrician gave some interesting experiments of the way in which the lamps can be manipulated. He would start one, ten, twenty, forty, or even seventy, at a time, first in this corner and then in that. No running around with dangerous matches.

Everybody was pleased and impressed with the exhibition. There is a relief for the thousands of operatives who are compelled to do night-work in the foul air of the overheated rooms in our great mills.

Life and Property Saved by the Use of Electric Light.

Translated for the REVIEW *from La Lumière Electrique.)*

The *National Belge* gives some details of an accident which happened on Sunday, the 18th day of August last, at the Eden Theater of Brussels, and in which electricity played a nearly Providential part.

An apparatus for the production of oxhydric gas, used to make light on the stage, having exploded, the disturbance in the atmosphere was so intense that all the gas lights were extinguished. It was very fortunate that not a single one of them continued burning, because the escaping gas would have taken fire, and the least spark might have produced a conflagration.

The house was then suddenly plunged in complete darkness, without the possibility of introducing any uncovered light except under imminent danger of fire.

Fortunately some "sun lamps" had just been installed in the building; they supplied the want of gas light, and the audience was permitted to withdraw without any panic.

The *National Belge*, in conclusion, calls attention to the great superiority of the electric light over the gas, in regard to such fire accidents, and the horrible panics which are apt to arise in such cases, and then adds: "We dare hope, with the great public, that, after such an experiment, the persons in authority, whose duty it is to guard the safety of the public, will not fail in taking advantage of such wise measures as are offered. In the presence of such a fact, inaction would amount to culpable negligence"

Electric Company Sold Out.

The stockholders of the Connecticut Electric Lighting Company have voted to sell the company's plant in New Haven to Herrick P. Frost, president of the Southern New England Telephone Company. The company had invested $53,000, and recently suspended operations because of losing money. Mr. Frost says he is not acting for the Southern New England Telephone Company, but on his own account.

The fact that the electric light produces very little heat in proportion to its illuminating power has been reduced to figures by Nature, which gives the following as the result of careful experiments: The heat from an arc lamp of 100 candle-power is from 57 to 158 heat-units, that of the incandescent lamp of equal brilliancy from 290 to 536. The argand gas-burner is the next best light in point of coolness, but this is represented by 4860 heat-units, a colza oil lamp by 6800, a flat wick petroleam lamp by 7200, a paraffine candle by 9200, and a tallow candle by 9700. Light for light, therefore, the heat of an electric arc lamp under the most favorable circumstances is to the heat of tallow candles as 1 to 170.

Electricity and Watches.

THE CURIOUS MANNER IN WHICH ELECTRIC MACHINES AFFECT WATCHES.

"If you have got a watch don't go near that machine," said Superintendent Redmond, of the Electric Light Company, to a reporter of the *Post-Express*, as he entered the company's building at the lower falls a few nights ago, having safely passed the "Positively no admittance" sign and gained an entrance at the usually barred gates. As he spoke he pointed to one of the five generators which stood on one side of the building, and which like all the others in use, emitted constantly bright sparks of light from the rapidly revolving machinery. Each of these generators keeps forty electric lights burning all night, and is run by the water power of the falls, one of the largest rubber bands in the State being used in making "the wheels go round." The noise in the building, caused by the thousands of revolutions a minute, is almost deafening, and conversation is impossible except at a lung-splitting tone of voice.

What possible connection there could be between such a large piece of machinery and a watch, even if it be of the lumbersome kind carried by the reporter, was not clear at a glance, and he looked interrogatively at the superintendent. "If you go within a certain distance of that machine," said Mr. Redmond, "it will spoil your timekeeper" Taking advantage of the "timely warning," the reporter kept within the proscribed limits, and gained some points of interest not generally known to the public.

One of the most peculiar things connected with the electric light machine is the curious effect it has on time-pieces. Placed within a few feet of the positive pole of the electric machine, the watch stops absolutely; if exposed immediately to the negative pole of the machine, it will resume its accustomed ticking, and it is said very little bad effect is noticed. Very many watches have been utterly ruined, however, by careless persons going too close to the machines, through ignorance of the neglect of attendants to warn them of their danger. None of the men employed at the works of the lower falls carry any costly watch, and Superintendent Redmond contents himself with a low-priced piece with American works, which is difficult to get out of order, and which, American like, will not admit of defeat from such a small concern as an electric-light machine.

One of the most prominent watchmakers in the city said to the reporter yesterday, "That electricity or magnetism is one of the worst things we have to deal with. A magnet would create more mischief in a half hour among these watches than it ever did in Grosvener's 'hardware shop' in 'Patience,' and more than I could undo in months. Perhaps I could never remove it entirely. I wouldn't have a horseshoe magnet in my place for a big sum.

"Yes, I've known of several watches being seriously injured by the electric-light machines. You see, the difficulty is with the balance wheel and hairspring, both of which are made of steel. The positive pole of the magnet influences them, and causes the watch to keep all sorts of unreliable time. While we can replace the spring very easily it is more difficult to remedy the balance of the evil. Principal John G. Allen of this city had a costly watch affected some time ago through exposure to the machine in Powers' block. I took it, and after working at it for three months, succeeded in demagnetizing it by the use of the negative pole of a magnet. That's the only case I've heard of in this city, although there are a few other cases where it has been done. The finer the mechanism the more damage is likely to be done, and it is through the most untiring patience that they can be brought around to anything like their original state; it's about one in a hundred that ever is."

The reporter also found a gentleman whose $150 chronometer had been ruined in this way."

Electric Light at Moscow.

Russian eccentricity and characteristic *astuteness* is well displayed in the illustration herewith given from our esteemed contemporary *La Lumière Electrique*. It will be observed that the lamps are not put under a barrel, as might be inferred, but the most of them are carefully arranged in the top of the church towers where an occasional ray glimmers forth from a port-hole.

"In our epoch great popular festivals can no longer dispense with the marvelous effects of illuminations which are obtained by means of the electric light; so, when last summer the Czar of all the Russias at last resolved to have his coronation accompanied with a solemn ceremony, the city of Moscow had prepared for the evening of such coronation feast a series of luminous decorations, which have made a profound impression on the gigantic mass of people gathered there from all the parts of the empire, and upon the innumerable visitors attracted from the diverse points of the ancient and new continents.

The national *Press* had greatly expatiated upon that grand manifestation of another age, and the military parades, the march of the imperial procession, and the popular rejoicings have been reported on all sides with the most minute details. The *amators* of the art of producing magnificent displays had during those memorable days in Russia a chance, probably unique of its kind, of contemplating splendors which could never have been realized before.

It was on the 28th day of May that the reception of the delegates of Cossack populations and Asiatic tribes took place at the Kremlin Palace. That part of the programme was especially curious on account of the strangeness of the costumes and types which were represented in those delegations sent from the remotest parts of the territory.

The Chamber of the Throne, also called Saint Andrew's Hall, had been prepared for the ceremony. Near one of its extremities arose the imperial throne, and on the left were placed the imperial insignia and flags of the empire. The grenadiers of the golden company in front formed the guard of honor, and the Czar and Czarina were standing on the platform before the sumptuously decorated throne. In measure, as each delegation appeared, their chief presented the gold and silver plate, upon which were the bread and salt, and which was afterwards deposited on a table placed on the side of the windows looking over to the Moskowa River. That plate was a real marvel of goldsmith's workmanship, measuring one yard in diameter, and bearing on both sides the imperial initials and the coat-of-arms of the Don. At the center a large medallion, representing the assembly of the Cossacks before the Cathedral of Novo-Tcher-Kaski, with the present Emperor, when he was the Ottoman of the Don, on the ledges—two other subjects, framed with golden eagles, on a ground of green enamel—and recalling divers episodes of Novo-Tcher-Kaski at the time of the sojourn of the future Emperor.

The promenade of the court in the Kremlin, which was brilliantly illuminated with electric light, took place at St. George's Hall The procession was headed by masters of ceremonies, clad in green tunics, overloaded with embroideries, and carrying, each one in his hand, a gilt staff two yards long, surmounted with a double-headed eagle. The orchestra was playing the "Polonaise" of Glenca, and at the sounds of that dance the imperial procession, guided by the Emperor, was executing the Kourka, the traditional promenade, through the crowd, which bowed respectfully.

Outside the popular festival was much more picturesque. It was held in the plain of Kodonskoïe-Pole, which is situated about one or one mile and half from the Twerskaïa Gate, opposite Petrowski's Castle, and on the right-hand side of the imperial road, which leads from Moscow to St. Petersburg. That plain, which measures about five square versts, had been fenced in by an inclosure of booths, presenting four hundred entrances. Each person passing through the gate received a small willow basket, containing two cakes, one pound of candy, one bottle of beverage, and one earthen cup. It has been reckoned that the number of persons who entered into that enclosure and received such popular presents amounted to four hundred and twenty-eight thousand.

There was in the center a circus, which could contain fifteen thousand people, and was flanked with four theaters, wherein they played dramas, pantomimes and great military pieces. Greasy masts and oriflammes, with Russian colors, were arising and flowing everywhere, and numerous orchestras were occupying beautiful stands. The allegoric cavalcade, entitled, "The Festival of the Spring," which started from the circus immediately after the arrival of the Emperor, was extremely curious. The whole of it was taken from the old Russian mythology, and the two cars of bees and Russian strength obtained a legitimte success of admiration. After those cars came a herald of arms, carrying an immense flag of golden cloth and a costume of Boyard of the time of Ivan the Terrible. Four warriors followed, carrying on their shoulders a sword the blade of which measured three yards in length It was the celebrated sword of Dobrina Nikitisch, who himself was represented in another car, leaning against an enormous dragon with three heads, and wings armed with steel prickles. That fantastic monster, as related by an old Scandinavian legend, lived in an enchanted grotto, and was exterminated by the famous Dobrina Nikitisch with the sword carried before him.

After those extra typical exhibitions of the day festival, the night feast had a splendor of which no comparison could give an idea. They had been for some time preparing some electric installations, and through successive experiments they had assured the perfect working of all the apparatuses. Never until then such a multitude of focuses had been kindled within the same space; sets of Edison's lamps rose upon the high tower of Ivan Velikoï, which rises in the center of the Kremlin, and formed silhouettes of fire with the most fantastic outlines. At the same time, the bell turrets of the most strange Cathedral of Vassili Blajenoï were illuminated with multi-colored facets; whilst the sparkling of electric points, following the battlements of the ancient citadel, and getting reflected by thousands in the bed of the Moskowa, seemed to give to the water of the river, usually so dark, the appearance of an immense sheet of metal in fusion.

On the eighteen towers of the Kremlin they had disposed enormous regulators, which carried far off their luminous pincels of rays, and caused the cupolas of the Terem, of the Temple of the Saviour, and of the cathedrals of the holy enclosure to get resplendent, as if under the effect of a continuous spark of lightning.

It is the last part of the illumination that our engraving represents.

It shows the immense pincels of light rays, emerging on all sides from the towers of the Kremlin, to project on the surrounding monuments, and gives an idea of the marvelous manner in which electric light contributed powerfully to increase the fantastic point of view of the festival by causing, better than any other light, the curious character of that picturesque decoration to resort."

Port-Hole Method of Electric Lighting in Moscow, Russia.

Electric Light vs. Gas.

A German scientific periodical says that experiments with regard to the temperature and quality of the air in buildings lighted with electricity and gas respectively, have been made in the Royal Residence Theatre, Munich. The increase of temperature was ten times as great in the upper gallery when gas was used to light an empty house as when it was illuminated by electricity. In the former case the temperature rose to 16½°, in the latter only 1.6°. In the lower part of the house there was naturally less difference. With a full house the difference was 11°, the temperature of the gallery being 84° with gas and 73° with electricity. The temperature was not so high in the third balcony with the electric light, as in the first with gas lights.

Telephonic.

The Central Union Telephone Company, of Chicago, have just declared a dividend of one and one-half (1½) per cent., payable on October 15th. The secretary is authorized by the Executive Committee to state for the information of stockholders that the earnings of the first quarter of the company's existence have exceeded their expectations, the company having more than earned the dividend just declared, and added to the surplus on hand at the commencement of the quarter. The gross earnings of the present quarter, as compared with the same quarter of 1882, of the companies from which this was formed, show an increase of $80,465.36. It is believed that the last quarter of this year will show still greater increase.

Telephone Extension.

CONNECTIONS BY WHICH BALTIMORE CAN SOON TALK WITH ANY MARYLAND TOWN.

The latest extension of the telephonic connections is between Baltimore and Alexandria, Va., by a continuation of the line from Baltimore to Washington. About sixty miles of wire are talked over in conversing with parties in Alexandria. Washington has a net-work of telephonic wires, and many suburban points are connected with the exchange. The Chesapeake and Ohio canal telephone is a private line, and was one of the first lines put up in the State. It runs from Georgetown to Cumberland, a distance of 185 miles. The Chesapeake and Potomac Telephone Company expect to make arrangements to have the wires of the canal company connected with their wires, so as to have commercial connections throughout the canal company's line and Western Maryland. The canal company's line will also be used as a through line to reach distant points, and will be connected with a system to reach all points in Maryland and probably many outside of the State. Hagerstown, Cumberland, Frederick, Annapolis and numerous other places will be connected with Baltimore. The Cumberland exchange connects with Frostburg and Lonaconing. The mines in this district are connected by telephone, and wires run from the mines to the houses of the various superintendents. There are also a number of private lines. Frederick is building towards Baltimore, and has completed seven miles. This line comes to Ellicott City. A line is already built from Baltimore to Ellicott City, where it will connect with the Frederick line. Baltimore will also have a second line to Frederick, by the way of Westminster, Uniontown, Union Bridge, Johnsville, Liberty and Mount Pleasant. A line is planned from Frederick to Washington, by way of Urbana, Hyattstown and Rockville. Baltimore will also have a line to Washington by the way of Frederick. The line from Frederick to Hagerstown passes through Boonsboro', Fairview and Middletown. There is a line from Hagerstown to Williamsport. The line connecting Baltimore with Hagerstown is now being built, and two and a half more miles of construction will put it in working order as far as Frederick. A line is being built from Frederick City to White's Ferry. A line is in course of construction from Baltimore to Annapolis, and will be ready November 1. This will secure communication with all the stations on the Annapolis and Elkridge Railroad. There are no public lines on the Eastern Shore, but individuals have wires running from point to point to facilitate business. There are likewise private wires at Havre de Grace and at other points along the Susquehanna River. Many new lines and connections are projected, among them a line from Baltimore to Belair, through intermediate points to Chestertown. Nothing is projected for the counties of Prince George's, Colvert, Charles, St. Mary's, nor for Anne Arundel below Annapolis. Inducements would cause the company to run lines through these counties to Drum Point; in Calvert, and to Point Lookout, in St. Mary's County. The system of telephones in Maryland and in the District of Columbia is controlled by the Chesapeake and Potomac Telephone Company, which comprises at present exchanges in Baltimore, Hagerstown, Cumberland, Frederick and Washington, D. C. The telephone system in Baltimore will be made entirely new by December 1. New switch-boards and other improvements will be put in and the service greatly improved. The telephone business throughout the State is greatly on the increase.

A Telephone Company's Tax.

TRENTON, Sept. 28.—The Trenton assessors this year for the first time assessed the telephones of the Delaware and Atlantic Telegraph and Telephone Company, which controls the Trenton Telephone Exchange. The valuation is fixed at $11,000, $50 apiece for each of 250 telephones. To-day the representatives of the company appeared before the Commissioners of Appeal and protested. A compromise was finally effected by which the Telephone Company will pay tax upon a valuation of $4,000.

The Lowell telephone dividends, just declared, are on 79,614 shares of stock, held by something over 2,600 people, who together will receive $121,142.

The Lancashire and Cheshire Telephonic Exchange Company, limited.

We are in receipt of the annual report of the Lancashire and Cheshire Telephonic Exchange Company, Manchester, England.

This company operates the Liverpool, Manchester, and several smaller exchanges, and stands at the head of English telephone companies.

The following extracts from the directors' report will show that their affairs are very prosperous:

Directors—Charles Moseley, Esq., Manchester, chairman; Eli Heyworth, Esq., Blackburn, deputy chairman; J. H. Agnew, Esq. (appointed by the United Telephone Company), Manchester; Joseph B. Morgan, Esq., Liverpool; F. W. Reynolds, Esq., Liverpool; George H. Robertson, Esq., Liverpool; Joseph Thompson, Esq., Manchester.

Secretary—Kenneth Maciver, Esq.

REPORT OF THE DIRECTORS FOR THE YEAR 1882-3.

The directors have much pleasure in stating that, notwithstanding the long and serious depression of trade in the cotton districts, they have to report a considerable increase of business. At the last annual meeting, the hope was expressed that the coming twelve months would bring new business to the amount of £10,000. This estimate has been exceeded, and the gross increase is nearly £12,000.

Much thought and attention has been given to the development of the lesser exchanges, and your directors have every hope that, with the advantage of intercommunication, the whole of the district exchanges will shortly prove remunerative. They have pleasure in stating that Preston, which was a heavy charge upon the company, is now contributing to the revenue, and all the users of the local exchange are paying subscribers.

The total income (including orders not completed, and for which payment had not been made) on June 30th, the close of the financial year, was £54,498 3s. 8d., as compared with £42,817 17s. 11d. last year.

The gross rentals applicable to the year's revenue (including the out-districts), amount to £45,544 12s. 2d, against £27,227 5s. last year.

The balance of revenue account, £13,734 4s. 4d., is much reduced in consequence of the cost of the specially heavy storms of December last, and serious fires, which have been charged to maintenance. This amount is estimated at £1,500. There is also a further heavy charge against revenue, amounting to over £700, arising from losses on trunk lines.

The number of calls has steadily increased. In Manchester it has averaged for the year six, and in Liverpool five, per subscriber per day. On one day, July 11th, there were 10,561 calls at the Manchester office, equal to 11.8 per subscriber.

Exchanges have now been opened in all the towns licensed to the company.

The total number of subscribers to the exchanges on June 30th, 1882, was 1,749, and of private renters 472. This year, to the same date, they were 2,359 and 697 respectively.

The directors have been most anxious to develop business between the different towns of their system, but hitherto they have been greatly hindered by the heavy amount of the subscription. They are happy to state that an agreement has been concluded with the Postmaster-General by which the rates of subscription will be considerably reduced, and they hope this will be found very advantageous to the subscribers, and that a satisfactory increase of business in this important branch of their operations will result.

In the conduct of the company's business, it is necessary to be in frequent communication with the post-office, both in London and the provinces; your directors are pleased to testify to the cordial relations which exist between them and the post-office authorities.

Telegraphy and Telephony in the Far North of Europe.

It is in Norway and the Shetland Islands that the most northern telegraphic offices are found. The most northern Norwegian telegraph office is the one which is established at Konigsvag, a putting-in port for whalers on the White Sea, and the telegraphic office situated at the extreme north of the British Islands is the one of Balta Sound, in the Isle of Unst, where, in 1817, Mr. Biot spent several months, occupied with his researches on the pendulum, and where tourists sometimes repair at the summer solstice to witness the wonderful sight of the sun shining at midnight. Within the few years last past, as it is known, the Norwegian telegraphic network has increased very rapidly. All the fishery stations are connected with telegraphic wires. In the same manner, in the British Islands, the communications for fishermen have greatly extended, and are continuing to increase permanently. At present, for example, the Fishery Board, the Edinburgh Post-office, the Aberdeen Chamber of Commerce, and the Selectmen of Lerwich, the capital of the Shetlands, are studying the project of the establishment of nine new fishery telegraphic stations in the Shetlands, Orkney, and Hebrides. The post-office, unable to assume the whole expense of those stations, have called on the inhabitants for local subscriptions. The nine stations to be created in those most distant islands are those of Castlebay, in the Isle of Barra; St. Margaret's Hope; Rearwick and Waila; Walsey, at the Shetlands; Tillswick; Westrey, at the Orcades; Carloway and Port of Ness, on the Lewis Isle, the largest of the Hebrides, which already possesses a telegraphic office at Stornaway, the capital of the island.

Telephones in Westminster, Md.

Edgar L. Miller, Superintendent of the Chesapeake and Potomac Telephone Company, was here to-day, says the Westminster correspondent of the Baltimore *Sun*, under date of the 26th ultimo, in the interest of his company. He talked with a number of prominent persons regarding the establishment of a telephone exchange here, and met with considerable encouragement. The company propose to connect with Union Bridge in a week or two, and to bring their lines here by way of New Windsor, and from here to continue them to Baltimore. From Westminster communication is to be established with the various towns of the county. The exchange will be in working order in November, at Westminster, Md.

The *Examiner*, Frederick, Md., says that "the telephone business in this city is on the increase. Mr. Charles D. Landerkin left this city Monday morning, to take charge of the Westminster exchange. He was formerly manager of the night exchange in this city. Mr. Victor M. Marken has been appointed to fill the vacancy occasioned by the promotion of Mr. Landerkin. Miss Mollie Burns has been appointed assistant operator of the exchange in this city."

A New Telephone Company.

ALBANY, Oct. 6.—The McDonough Telephone Company was incorporated to-day. The capital is $1,000,000, with the proviso that it may be increased to $20,000,000. The principal office will be in New York. The lines are to extend from New York to San Francisco, New Orleans, Portland, Me., Boston and other places. The incorporators are James W. McDonough, George R. Williamson, and Henry C. Townsend of New York; William J. Van Pelt, Jr., of Hoboken, and George W. Coy of Milford.

The scarcity of gentlemen at a neighboring summer resort was so apparent that a Boston lady telegraphed to her husband: "George, bring down a lot of beaus for the hop this evening." Thanks to the telegraph manipulator, who wished to do an astute thing, George arrived with a "pot of beans."

Telephone Fire Alarms.

With telephones multiplying on every hand, so that these instruments are no longer a novelty, even in the smallest and most obscure towns, there has recently arisen a new method of utilizing them, which promises much of benefit and security to the possessor. We refer to the experiment already successfully performed, by which use is made of the telephone exchange as a headquarters for sounding an alarm of fire when notified by a person connected with it. Messrs. J. H. Bunnell & Co., electricians of New York, have recently placed an apparatus of this kind made for them by Mr. Geo. M. Stevens of 90 Sudbury street, this city. It is located in the city of Scranton, Pa., and consists of a steam whistle on the Oxford Coal Works connected by electricity with the headquarters of the North Pennsylvania Telephone Company, distant about ¼ of a mile, by which an alarm signal is blown whenever a fire is reported in any of the districts into which the place is divided. It is also sounded at 7 A. M., 12 M. and 6 P. M. to give city time, and it is of sufficient size to be heard a distance of five miles. By means of an arrangement of this kind any person connected with the central telephone office is able to have the fire department of the city or town in which he lives notified of the existence of a fire in his establishment or vicinity without a moment's delay, thereby securing most of the benefit of an elaborate city fire alarm system with but a very small part of the expense. To Mr. R. O'Brien, President of the North Pennsylvania Telephone Company, is due the credit of the first practical inauguration of this plan. Its advantages, considering the moderate expense necessary to introduce it, will at once be apparent to any one.

Telephone Lines Assessed.

CONCORD, N. H., Sept. 29, 1883.—The State board of equalization has made the following valuation and assessments against telephone lines doing business in New Hampshire:

Companies.	Valuation.	Taxes.
Plymouth & Camptom....	$2,000	$25
Brattleboro & Chesterfield.	1,000	12
Brattleboro & Hinsdale....	800	10
Boston & Northern	125,000	1,546
Cheshire County.....	23,000	284
Winnipiseogee Bell.....	4,000	49
Granite State.....	82,000	1,014
Stratford & Colebcook....	500	6

Telegraphic.

The Santa Fe's Telegraph Line.

DALLAS, TEXAS.—The Gulf, Colorado and Santa Fe Railroad Company have succeeded in completing their telegraph line through from Cleburne to Dallas in spite of the injunction of the Western Union Telegraph Company, thus completing a wire along its entire route. The Western Union based its injunction on an alleged contract between it and the old Chicago, Texas and Mexican Central Railroad before it was purchased by the Santa Fe Railroad, by which the Western Union was to bear a part of the expense of erecting and maintaining the telegraph line, and to share equally in the profits. The purchasers refused to recognize such contract, and the officials of the road succeeded in dodging the officers and preventing service until the wire was completed.

The First Electric Telegraph.

The idea of the practical application of the electric telegraph to the transmission of messages, says a writer in *Engineering*, was first suggested by an anonymous correspondent of the *Scots Magazine*, in a letter dated Renfrew, Feb. 1, 1753, signed C.M., and entitled "An Expeditious Method of Conveying Intelligence."

After very considerable trouble, Sir David Brewster identified the writer as Charles Morrison, a native of Greenock, who was bred a surgeon, and experimented so largely in science that he was regarded in Renfrew as a wizard, and eventually found it convenient to leave that town and settle in Virginia, where he died. Mr. Morrison sent an account of his experiments to Sir Hans Sloane, the President of the Royal Society, in addition to publishing them anonymously, as stated above.

The letter set forth a scheme by which a number of wires, equal to the letters of the alphabet, should be extended horizontally, parallel to one another, and about one inch apart, between two places. At every twenty yards they were to be carried on glass supports, and at each end they were to project six inches beyond the last support, and have sufficient strength and elasticity to recover their situation after having been brought into contact with an electric gun-barrel placed at right angles to their length, about an inch below them. Close by the last supporting glass a ball was to be suspended from each wire, and at about a sixth or an eighth of an inch below the balls the letters of the alphabet were to be placed on bits of paper, or any substance light enough to rise to the electrified ball, and so continued that each might resume its proper place when dropped. With an apparatus thus constructed the conversation with the distant end of the wires was carried on by depressing successively the ends of the wires corresponding to the letters of the words, until they made contact with the electric gun-barrel, when immediately the same characters would rise to the electrified balls at the far station. Another method consisted in the substitution of bells in place of the letters; these were sounded by the electric spark breaking against them. According to another plan the wires could be kept constantly charged and the signals sent by discharging them. Mr. Morrison's experiments did not extend over circuits longer than forty yards, but he had every confidence that the range of action could be greatly lengthened if due care were given to the insulation of the wires.

7 COUNCIL HOUSE ST.,
CALCUTTA, 4th Sept., 1883.

Editor Electrical Review:

DEAR SIR:—I suppose you will almost have made up your mind by this time that your worthy correspondent in far-off land has been swallowed up by a Bengal tiger, or knocked under by the "Asiatic Cholera," that frightful disease which we hear so much about nowadays, andwhich has to bear the anathemas of all parties in this country just now for being the cause of delaying our weekly communications with the civilized world, but I am glad to be able to inform you that he is not, and that he has quite "enough there" to do his little best to give you some account of the coming "Calcutta International Exhibition."

To begin with, it is to be, according to Eastern ideas, a very grand affair; but I am afraid that when it is compared with the magnificent pagents which of late years have taken place throughout Europe and America, it will sink into insignificance. It is to be held in the Museum and adjoining buildings which are being erected for the purpose on the large park, or "maidau," as it is called here, in the center of the town. There is no doubt that it will attract an immense number of natives from all parts of India, to pour their money into the pockets of the enterprising Australian professional expositionist, who is the promoter, on, I believe, purely speculative motives, but as an exhibition as a means of advertising specialties, etc., I do not think it will come up to the mark that is expected, as it is such a long way to send things on the off chance of disposing of them, more particularly when every one knows that this is about the worst market in the world for machinery, etc.

As for electrical exhibits, as far as I could make out from Mr. I. Loubert, the promoter, there will be little or none, with the exception of the electric light companies, seven of whom have tendered for the contract to light the buildings, some of which have tendered at the extremely low figure of 000. My company's operations will be confined to the opening of an office in the building for the convenience of the public, and connecting the Opera House stage with it for the amusement of the natives; not much, you see.

The grandest sight of the whole business will be the array of jewelry to be lent by the native princes for the occasion. Such a sight as it will be ought to repay one for a visit, as all the crown jewels of all the Rajahs, Maharajahs, Begums, etc., in India, are to be there. The whole exhibit will be worth the modest little sum of £10,000,000 sterling. It would not be a bad idea for some of your pet burglars to come out and try their hands on that. No more of the Exhibition now till I can find out something more definite to tell you.

The telephone has been making rapid strides since I last wrote to you, and new subscribers are coming in daily, and people who have shares in the business are beginning to hope for a plump dividend. Opposition is coming into the field also, which is always a healthy sign. In this case it is only in the shape of a company which proposes to use the Crossley microphone, and who advertise that they are going to supply the instruments, which are acknowledged in all parts of the world as the best.

I inclose you a cutting from a local daily, which will give you some idea of their own opinion of themselves. It was written by their manager I hear. No more now from

Yours faithfully,
"BENGALL."

The multiple switchboard, built by the Western Electric and recently put into the Memphis exchange, is said to be working splendidly.

"A Cold Day When Uncle 'Rufus' Ice-House Burns Down.

"What do you propose to do about the decision of the Court of Appeals regarding the Western Union case?" asked a *Commercial* reporter of Mr. Rufus Hatch.

"I haven't consulted my lawyer yet," was the reply.

"But you know whether you propose taking some action?"

Here Mr. Hatch approached the reporter, and throwing his arm about him, drew him near, and whispered confidentially in his ear, "It's a cold day when Uncle Rufus let's his ice-house burn down." Then smiling broadly the financier waved an adieu and walked away.

A Magneto-Electric Call-Bell.

An ingenious call-bell, dispensing with batteries in telephony, has been invented by M. Abdank-Abakanowicz. It is especially useful in long-distance telephoning, where relays would have to be used for the call-bells, or else a very powerful battery. The transmitter consists of a U magnet between the branches of which is placed a bobbin having a soft iron core. The bobbin is carried by a spring fixed at its other end to a solid support or frame. This bobbin is withdrawn from its position of equilibrium between the poles by means of a handle attached to the frame of the coil. Under the action of the spring the bottom oscillates between the poles, thereby setting up undulatory currents of electricity in the bobbin which is in circuit with the line. These currents lasts some seconds until the bobbin takes up its normal position of rest. After traversing the line they pass through a receiver, consisting of a similar bobbin carried by a spring in a magnetic field. This bobbin is, however, fitted with a bell clapper, and when it oscillates with the magneto current it strikes the two gongs or bell plates.—*Engineering, London.*

Pratt's Hotel and the telegraph office, at Rosseau, Ontario, were destroyed by fire on Friday night.

Officers of a Telegraph Company.

WHITE RIVER JUNCTION, Vt., Oct. 3.—The adjourned annual meeting of the stockholders of the Vermont and Boston Telegraph Company was held here to-day, and the following board of directors was elected: Norvin Green, David H. Bates, Charles A. Tinker, Roswell H. Rochester, of New York; Norman Williams, of Chicago; Thomas Roche, of Boston; G. W. Gates, Henry C. Sherman, George W. Smith, of White River Junction. The officers are Norvin Green, president; D. H. Bates and C. A. Tinker, executive committee, and R. H. Rochester, secretary and treasurer.

INCORPORATED.—At Columbus, O., on September 22, the Automatic Telephone Burglar and Fire Alarm Company, of Toledo; capital stock, $30.000.

Rhode Island Telephone and Electric Company.

This company has recently been formed in Providence for the purpose of dealing in and applying, in any part of the country, electrical instruments of various descriptions. The company is composed principally of the gentlemen who form the present Providence Telephone Company, and its formation and purposes are entirely in accord with the existing powers that be in telephonic matters. The officers of the company are: Hon. H. Howard, president; J. W. Duxbury, president; and C. T. Howard, treasurer and general manager—Mr. Howard being also president, Mr. Duxbury, general manager, and Mr. C. T. Howard, treasurer, of the Providence Telephone Company The directory is substantially the same as in the Providence Company, comprising men of national reputation—commercially, politically and socially—and the company having ample means, is prepared to treat for the purchase or introduction as agents of any and all devices in electrical appliances. The business of the company is carried on in four departments, viz., telephone apparatus, electric apparatus, time telegraph, and lightning-rod department. Already the company has secured the control of a number of patents and valuable electric rights, and have different forces of men at work in Massachusetts, Rhode Island and New York. It has also equipped several large telephone offices with their improved switchboards, the same as are used in the Providence Telephone Exchange, and has extensive orders ahead in this department. Among the devices controlled or owned by the company are the following of interest to telephone men, which are all patented:

The Wright patent cable clip, which is the most economical device for suspending cables. It is light, strong, easily applied, and cannot rust. It is highly recommended by the managers of the Boston, Washington, Providence and other telephone companies here and in Canada.

The Howard safety appliance, which is a lightning arrester, cut out and fusible wire, to be placed outside the house to be protected. The electric current is entirely cut off from the inside of the building at the will of the subscriber, while fusible wires afford additional protection should an excessive charge be thrown upon the line when the instrument is in circuit. It is in use in Providence and elsewhere, and is gaining in favor every day.

The Breckenridge jack, which, after two years' trial, has proved its value in twenty telephone exchanges, and is warmly recommended by all who have used it. It is a simple device for looping in the Central Office telephone without breaking circuit, or interfering with the conversation of subscribers using the line.

The Providence switchboard, which is that invented by Mr. Breckenridge, of the Providence Company, is at present used exclusively in the Providence Central Office, where 1,800 lines center in one room. This switchboard is the most compact yet invented. It brings all the working parts together without stretching, and is indispensable to quick work in a large office. All the connecting wires being encased in rubber, it has no leakage or induction, and is the only switch that can be used advantageously for metallic circuits.

The Farmer and the Telephone.

A farmer stepped into Wells, Stone & Co.'s office yesterday morning and wanted to sell a load of apples. The buyer for the firm was at the telephone, and the financial man told the farmer to wait a moment; and as the buyer turned from the telephone, the man of cash, who was busy, attracted his attention by a nudge, and pointed to the apples. He went out with the farmer and asked him what his apples were worth. The farmer went down into his pocket and pulled out a dollar, and pointed to the bushel basket on the load. The buyer said, "That's too much. I'll give you 75 cents." The farmer shook his head and flourished the dollar. He was told it was too much, and that he must take something less. He took out a scrap of paper and wrote 85 cents and $1, and then by motions indicated that he would take 85 cents for one lot and $1 for the others. The buyer said, "All right, but why don't you talk?" The farmer found his tongue, and replied, "Why, ain't you deaf?" "Not that anybody knows of." "What did you have that tube to your ear, then, for?" and the man from the rural districts learned about the telephone.—*From the Saginaw (Mich.) Courier.*

Victory for the Western Union.

The Court of Appeals at Albany, N. Y., has rendered a decision in the Hatch-Williams cases *vs.* the Western Union Telegraph Company, reversing the decision of the General Term and affirming the judgment of the Special Term, which is in favor of the company.

The attorneys for Hatch & Williams state that if the Western Union decision is as reported it is final.

Direct telephonic communication is now in operation between Berlin and Magdeburg, about a hundred English miles distant.

Somebody has been bright enough to say: "Langtry and Gebhardt—the Lily of the Valley, and the Valet of the Lily."

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The Success of the Telephone and Electric Light.

It was said of a wealthy New Yorker, recently deceased, that he carried pessimism so far that he could not believe in the possibility of good even when it was present, and he was profiting by it to an extent far beyond even what the optimists had prophesied. When his income reached nearly $100,000 a year, he sighed and groaned in agony for that, to his mind, it would require the greatest economy on his part to save him from an old age of penury and want. In a few minutes' conversation, it was said, he could make a rich man feel poor, and a poor man feel hungry.

In a not dissimilar mood the skeptics have looked upon the projection of electrical enterprises. To their minds the electric light was a sham, a bauble whose only practical use was to allure the credulous and to despoil the innocent; the telephone, an instrument more potent for the shearing of lambs than for the transmission of messages.

This being the case, how now must be the condition of these poor skeptics. The telephone has, of late, made the most magnificent strides into popular favor, indeed it has in many quarters become a necessity, and the electric light and the motor have now reached a point in practical efficiency that indicates beyond peradventure, the possession of all the elements and conditions that go to make up a thorough commercial success. Therefore, it would seem a fitting time for the skeptics to somewhat modify the lugubrious, oleaginous expression with which, for some time back, they have been wont to assume, when casting the electrical horoscope.

"The picture in the foreground, ladies and gentlemen," said Artemus Ward, while exhibiting his "highly moral show" of wax "figgers," "is a horse. I know it's a horse, for the artist that made it told me that that's what he intended it for." In like manner we can assure the skeptics that both the telephone and electric light are successes, because the men that manufacture them have demonstrated to the public the practicality of both. More than this, they are now engaged in turning them out of their shops as fast as their men, many of whom are working overtime, can complete them.

The telephone is, of course, spreading with the greatest rapidity, because it was at first introduced to the general public. Large as is the field now covered by the telephone systems from the Gulf of St. Lawrence to the Pacific, the demand yet unsatisfied for telephone service is almost limitless.

Nor is this strange. In business the telephone has proved itself to be indispensable. Many a sharp run just before the close of the banks has been saved the merchant by means of the little transmitter suspended above his desk, and many an awkward mistake, discovered when almost too late, has, by means of this little instrument, been rectified.

In electrical lighting the recent improvements in the voltaic arc system have greatly reduced the cost of lighting theatres, halls and the public thoroughfares, and the incandescent system is rapidly dispossessing the noxious fumes that have for so many years been carefully led into the office and the dwelling.

The electric motors have proved so efficient where they have been used that those who have paid for them have indicated a readiness to expend more money in the same direction.

All this has proved the wisdom of the projectors, the intelligence of the inventors, and, we were about to add, the folly of those who presage failure for that which they do not understand.

The Importance of Mathematics.

It is a curious fact, but one which may easily be verified, that some of the most skillful inventors have been singularly wanting in mathematical knowledge. As a result, as soon as they attempt to make estimates, they are found to be all out of the way, to use a common expression. We have known a man, an eminent electrician, who possessed so plentiful a lack of mathematical knowledge that he couldn't put pencil to paper without leading himself astray, and every time he essayed to estimate the cost of an electric lighting plant he got a different result, until at last his friends, wearied in pointing out his errors, paid no more attention to his estimates.

Again, those inventors whom we have known to employ so-called mathematicians as sort of dry nurses have been, generally speaking, not over-successful in their selections. The most absurd errors were continually to be seen in their computations, and these appearing in the press reports, led the public to believe that a stock-jobbing scheme was behind the figures, or else that the projector who had caused the estimate to be made was as mad as a March hare.

Yet, if there is one thing an inventor should be proficient in, it is mathematics.

With a good knowledge of mathematics, mechanical drawing, and physics, he can get over ground very rapidly. These accomplishments will enable him to fly while his fellow without them is crawling slowly along. In mathematics, algebra is decidedly the most valuable assistant to the inventor. This art was first known in the fourth or perhaps the sixth century, being attributed to Diophantus, and was revived in the sixteenth with Cardan and Tartaglia, but did not make rapid advances until toward the close of the sixteenth century and the beginning of the seventeenth, when Vieta, Harriot, and Descartes put it into a condition corresponding with the growth of other sciences at that period.

The most signal attempt to fix the place of algebra as a science, since the early writers, who called it universal arithmetic, was that of Sir Wm. Rowan Hamilton, who, led by a passage in Kant to consider a science of time possible, endeavored to construct it, and found himself led inevitably to a reconstruction of the elements of algebra. Since then great attention has been paid it by scholars. The late Prof. Benjamin Pierce, of Harvard College, succeeded in making some very valuable improvements in algebraic methods in his Linear Algebra, and just before his death is said to have succeeded in greatly simplifying certain formulæ, but just what these consist of we are not enabled to say, as his son, Prof. James Mills Pierce, has not yet made them public.

Quite frequently, while looking over the pages of our scientific exchanges, we see algebraic examples—or, rather, algebraic tangles—which have been sent them to unravel. These are sent for the most part by inventors, electricians, and mechanicians, who have been unable to pull through, as one might say, or have become entangled by useless complications interjected by themselves "unbeknownst," as it were.

Generally speaking, the solutions which these anxious inquirers look for are forthcoming, but sometimes there seems to be a desire on the part of the afore-mentioned contemporaries to let the public reader try his hand at answering as well as asking mathematical conundrums, especially those which do not look very inviting. Here is one, for example, which appears in the pages of an esteemed contemporary of ours, and as no one seems inclined to give the poor fellow a solution—though, from what he says, one would think that it was the one thing he needed in this life to make his happiness complete—we will go to his assistance, and, if we fail, we hope some of our correspondents or readers will kindly point out our error, not only that "Electro-Dynamics" may be put on the right track, but also that we may be warned against a like mistake in future. "Electro-Dynamics" says he has got the statement of his formula, but though he has labored long and diligently, cannot find the values of x, y, z, and γ. We have given:

$$X^n(X^n + Y^n + Z^n + \gamma^n) = a$$

$$Y^n(X^n + Y^n + Z^n + \gamma^n) = b$$

$$Z^n(X^n + Y^n + Z^n + \gamma^n) = c$$

$$\gamma^n(X^n + Y^n + Z^n + \gamma^n) = d$$

Now, if we divide the first, second, and third respectively by the fourth, we shall have:

$$\frac{X^n}{\gamma^n} = \frac{a}{d} \therefore X^n = \frac{a\gamma^n}{d}$$

$$\frac{Y^n}{\gamma^n} = \frac{b}{d} \therefore Y^n = \frac{b\gamma^n}{d}$$

$$\frac{Z^n}{\gamma^n} = \frac{c}{d} \therefore Z^n = \frac{c\gamma^n}{d}$$

If we substitute these values in the first equation and reduce, we shall find:

$$(a+b+c+d)\frac{\gamma^n}{d} = d^n \therefore \gamma = \left\{\frac{d}{a+b+c+d}\right\}^{\frac{1}{n}}$$

Hence,

$$X = \left\{\frac{a}{a+b+c+d}\right\}^{\frac{1}{n}} \qquad Y = \left\{\frac{b}{a+b+c+d}\right\}^{\frac{1}{n}}$$

$$\text{and} \quad Z = \left\{\frac{c}{a+b+c+d}\right\}^{\frac{1}{n}}$$

Protection for the Wolves.

In the new British patent law, which will go into effect on New Year's day, there are some novel and, it must be said, important departures from present methods. These innovations look to a better protection to the inventor, and may be said to offer a premium to genius instead of to quackery, as heretofore.

Under the new law, an inventor in any part of the world can secure a patent in England, by complying with a few prescribed rules.

The Examiners will not, like ours, search the records of the bureau to see if the invention has already been registered; they will simply come to a decision as to its value, in either a scientific or commercial sense. But this formal recognition does not give those who infringe upon the patents of others any better standing before the courts where suits will lie, as formerly, against false claimants. If any man considers his rights interfered with he may have redress.

Best of all, those who make improvements upon the inventions of others must pay a royalty for the use of the original invention.

This is one of those—we were about to say rare—cases where patent law agrees with common sense and the principles of justice.

There will be many, no doubt, who, not without reason, may claim that the objects of this new patent law in Great Britain emanates from other than disinterested motives; that it means little more than that the wolves, having secured their loot, threaten to tear each other for its possession, and are perforce compelled to ask the assistance of the hunter, that they may be left in undisturbed possession each one of his booty.

Let us explain:

Both the voltaic ark and incandescent systems of electric lighting, now in use in England, and the charged-rail system of electric propulsion—of which the other methods are but adaptations—have been filched from American inventors without so much as a by-your-leave. The first practical use of the electric light made in England was the work of an Englishman, who came over to this country with a letter of introduction to an American inventor, then at work on the incandescent problem. This man, who by the way was a professor, said that he would like to look through the laboratory and workshop, "simply out of curiosity, you know." When he had discovered the mechanism of the incandescent lamp, however, he hurried back to England, got up an electric company, and boldly claimed the invention as his own. Like many of his countrymen, now posing as inventors, he had the effrontery without the manliness of the highwayman, for when the latter is cornered he fights, while the former whines and lies.

Thus, when they fail to prove that they made these discoveries in electric lighting, they will change their tack and say that, at any rate, the principle on which all machines for electric lighting and electric railways

rests, was discovered many years ago by one of their own countrymen, Faraday. This is true, and it is even true that both the incandescent and voltaic arc systems were discovered a long while since; but it remained for American ingenuity to invent mechanisms whereby these lights could be utilized for practical purposes, and they had no sooner succeeded than the results of their labors were gobbled up and claimed by English adventurers.

The American owners tried to protect their rights, but the British patent laws, like all other British laws, are of such peculiar construction as, while seeming to be most fair, are in reality so elastic as to afford no protection whatever to the foreigner. All these English claimants had to do was to put on what they claimed to be an improvement on another man's work, and that sufficed to give them a right to it. But now, it seems, some of their own countrymen have "twigged the game," so to speak, and are about to make a few improvements themselves. This is a little too much for the big corporations who are rapidly becoming rich from that to which they have no right whatever, and so they are having the patent laws changed to protect themselves.

Acerrima proximorum odia. The hatred of those who are the most nearly connected is always the most inveterate. Family disputes, or those between citizens of the same State, are usually conducted with more acrimony than those between persons unallied by the ties of consanguinity, just as the animosities engendered by civil wars are infinitely more deadly and implacable than those which subsist between enemies of different nations.

To allay these internecine quarrels, the present law, it is said, was placed upon the English statute books. It enables the men, whose practices have already been described, to keep what they have stolen, but should any one else seek to steal from them, they must pay a royalty!

But who that has intelligently studied the conduct of Britain will not have long ago discovered that the theory, which is exemplified in this new patent law, pervades all her international affairs. She broke every international engagement with us during our war; openly aided our enemies while they were strong, deserted them when they grew weak, and then, finding that she would be greatly exposed should we retaliate in kind, when she should be at war, immediately ate humble pie and paid over seventeen millions of dollars in order to secure herself against similar treatment. *Perfide Albion!*

It is a fault which has marked the labors of some of our most eminent inventors, that they have made public their inventions before they are entirely complete and finished, and this furnishes the idea-hunters with their stock in trade.

Ardent in the commencement, careless toward the conclusion, is a bad rule. It is a fault common to many in the conduct of their affairs, and one which always ought to be guarded against; for, without perseverance and steadiness, few projects can ever be brought to perfection, and without these essential qualifications no difficulties are ever surmounted, no consummation is ever attained. And how many once flourishing concerns do we see crumble away, how many once thriving establishments dilapidated, through this defect in the conductors!

The Cincinnati Telephone Convention, from present indications, promises to be more interesting than any heretofore held.

The Pittsburgh *Dispatch* says: "A new company is about to commence operations in this city for the manufacture of carbons for electric lights. The company has a capital of $50,000, and intends to begin work just as soon as the stamps and machinery arrive, and they are expected every day. The carbons for electric lamps are made from petroleum coke, and the Standard Oil Company has a monopoly in furnishing this material. The coke for the new company will be furnished by the independent oil factory of D. P. Reighard & Co

Electrical Notes.

New processes for cheapening the production and increasing the purity and illuminating power of gas are being fully discussed, and improved burners approaching the intensity of the electric light, though undoubtedly more expensive, are beginning to appear.

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As a proof of the superior economy of the electric light over gas, the latter, when used to feed a gas-engine working an electrical generator, will produce more light than when used directly as an illuminant.

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Gas used as a fuel has an important field before it, and there is reason to believe that in the future it will be almost exclusively used as such.

***

The greater efficiency of gas as a fuel results chiefly from the circumstance that a pound of gas yields in combustion twenty-two thousand heat units, or exactly double the heat produced in the combustion of a pound of ordinary coal.

***

This extra heating power is due partly to the freedom of the gas from earthy constituents, but chiefly to the heat imparted to it in effecting its distillation.

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Recent experiments with gas burners have shown that, in this direction also, there is much room for improvement.

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The amount of light given out by a gas flame depends upon the temperature to which the particles of solid carbon in the flame are raised, and Dr. Tyndal has shown that, of the radient energy set up in such a flame, only one twenty-fifth part is luminous.

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The hot products of combustion carry off at least four times as much energy as is radiated, so that not more than one-hundredth part of the heat evolved in combustion is converted into light.

***

This proportion Dr. Siemens thinks could be improved by increasing the temperature of combustion, which may be effected either by intensified air currents or by regenerative action.

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Supposing that the heat of the products of combustion could be communicated to metallic surfaces and be transferred by conduction or otherwise to the atmospheric air supporting combustion in the flame, we should be able, he thinks, to increase the temperature accumulatively to any point within the limit of dissociation.

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This limit may be fixed, he says, at about 2,300° C., though even then it will be below that of the electric arc.

***

But even if it could be made more intense than the electric light, and even if it could be made far cheaper, even then it could never compete with the electric light, never prove a dangerous rival for a reason which will be immediately obvious to all intelligent persons, because it vitiates the atmosphere and consequently predisposes to disease.

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For surely a farthing dip with pure air is preferable to the most luminous gas-jet and noxious vapors!

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As said before, in the production of mechanical effect from heat gaseous fuel presents striking advantages, as will appear from the following consideration:

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When we have to deal with the question of converting mechanical into electrical effect, or *vice versa*, by means of the dynamo-electric machine, we have, says Dr. Siemens, only to consider what are the equivalent values of the two forms of energy, and what precautions are necessary to avoid losses by the electrical resistance of conductors and by friction.

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The transformation of mechanical effect into heat involves no losses except those resulting from imperfect installation, and these may be so completely avoided that Dr. Joule was able by this method to determine the equivalent values of the two forms of energy.

***

But, in attempting the inverse operation of effecting the conversion of heat into mechanical energy, we are confronted by the second law of thermo-dynamics, which says that whenever a given amount of heat is converted into mechanical effect, another but variable amount descends from a higher to a lower potential, and is thus rendered unavailable.

On the Economy of Siemens and Halske's Incandescent Lamp.

By Sir William Siemens.

The question of the economy of incandescent illumination is a double one, and should take into consideration the cost of installation and the cost of working. In a certain sense the two are inter-dependent, for if, for example, a certain number of 16-candle lamps can be worked with a relatively small application of power, a corresponding reduction in the machinery is possible. But a very important item besides is the cost of the conducting system, and in this respect the difference between the various systems is remarkable. In both respects has the incandescent lamp of Messrs. Siemens and Halske made considerable progress of late, as we will shortly describe.

We will first give a table showing the comparative value of the magnitudes concerned in the cases of the new Siemens and Halske lamps, their former lamps, and the Edison A lamp:

	New Siemens and Halske Lamps.			Earlier Siemens and Halske Lamps.			Edison A Lamp.
	II.	IV.	VI.	II.	IV.	VI.	
Normal candles	12	16	95	12	16	95	16
Volts	100	100	100	102.1	101.4	101.7	100.4
Amperes	.41	.55	.80	.70	.72	1.15	.71
Ohms (warm)	244	182	125	204	141	88	141
Volt (amperes)	40.05	55	80	51.5	72.6	116.9	71.5
Candles per elec., H. P.	210	290	221	165	157	152	159

The lowest row of this table, giving the number of normal candles furnished per electrical horse-power, shows the advantage of the New Siemens and Halske lamps in the economical application of the power-creating illumination. As was stated in the March number of the *Electrotechnische Zeitschrift*, 1883, an improved economy can be effected both by increasing the temperature and by a judicious choice of the substance of the reflecting surface. Care must, however, be taken that changes in this respect do not lessen the durability of the lamps. The improved results of the new Siemens and Halske lamps are entirely due to a new choice of the carbon material, and to its mode of preparation. Though it would be extremely hard to give an exact assurance that the temperature of the carbon filament of the new lamps is no higher than with the old lamps and the Edison A lamp, still a fair indication of the fact may be found in the comparison of the color and the polish of the filament, for color is a very delicate index of differences of temperature. The table shows that about 160 normal candles can be obtained per electrical horse-power. The change in this useful effect with a few candles is also apparent. The Edison A lamp, and the Siemens and Halske II., IV., VI. lamps, are arranged for the same pressure of 100 volts, so that they can all be burnt between the same leads at the same time. The color is in that case identical in each lamp, so that temperature differences of any great extent may be considered eliminated, and small differences at most can be present, to the disadvantage of the Edison and of the older Siemens and Halske lamps. For with identical color taken as granted, it must be allowed that the temperature of the Siemens and Halske lamps is in consequence of this economy of 210 normal candles somewhat lower than with the Edison lamp, because this increased economy is a proof that in the Siemens and Halske lamp the radiation is relatively rich in rays of a shorter wave length, which gives a whiter tone to the light in consequence. The Edison A lamp shows an economy of 200 normal candles per electrical horse-power when 114 volts are applied to it, which results in an intensity of 25 candles. The filament in this case, when compared with that of the new Siemens and Halske lamps at normal intensity, appears blinding white and very much overheated. Thus the new lamps give a decidedly higher economy than the older lamps or than the A lamp of Edison. The table shows that the increase in light which is afforded by the new lamps is 30 per cent. of the light furnished by the same power in the older lamps. A different percentage will result upon comparing the new and old II. lamps, IV. or VI. lamps together. The reason lies in the fact that the economy of the older lamps varied among themselves, which would not be the case had the temperatures been the same. Ten lamps of each sort were taken out of stock at random, and the numbers given in the table are the averages of the results of these lamps. It is no accident that the new VI. lamp has the relatively high economy of 221 nominal candles per horse-power. This type has a considerably greater cross section than Nos. II. and IV., and supports on that account a somewhat higher tension. The second step in advance which has been taken with the new lamp is to increase the resistance. In general, there is nothing to prevent an increase of resistance being given, for a variety of profiles can be given to the cross section, maintaining the surface of the carbon the same. This necessitates a corresponding increase in the pressure. By means of a carbon material of excellent emissive capacity, however, it has been found possible to reach a greater resistance without changing the pressure, which is an advantage, because the working is all the steadier and better the smaller the pressure. The economy of the leads, however, depends only upon the resistance of the lamps, and not upon the pressure. Let us compare an Edison A lamp and a Siemens and Halske IV. lamp, both at 16 normal candles, and with 100 volts of pressure. Since the A lamp requires about 30 per cent. more power than the other of the product E C (since E is the same in both) the factor C must be 30 per cent. higher. Therefore, the resistance of the IV. lamp must be 30 per cent. higher than the resistance of the Edison lamp, and a different form of surface is required. The lengths of both carbons are approximately the same, while the cross section in the Siemens and Halske lamp is smaller.

It follows that the more emissive of light rays a substance is, the smaller should the cross section be made for a certain purpose and candle-power. In general, this is no advantage, but Messrs. Siemens and Halske have been fortunate enough to find a material

which is particularly well adapted to thin filaments, and the results as regards durability have been satisfactory.

Touching the saving in the materials of the conductors arising out of the higher resistance and the accompanying reduction in current, the effect will be different according as smaller or greater lengths of circuit are employed. The former case (of rare occurrence) arises when the strength of current alone gives the data for settling the cross section of the lead. As I pointed out in the March number of the *Electrotechnische Zeitschrift*, the diameter of the conductor is to be proportional to the current. Thus, when only half the current is necessary, the material of the leads is only one quarter. With the new Siemens and Halske lamps the current is 30 per cent. less, which gives a saving in leads of over 50 per cent.

The second case occurs when the cross section must be made (on account of absorption of power in overcoming resistance) greater than if considered with respect only to the current. By increasing the resistance of the lamps 30 per cent., the cross section of the conductor can be diminished 30 per cent.

The new Siemens and Halske lamps therefore show a marked improvement in economy. Not only is the power necessary diminished by about 30 per cent., but there is also a notable lessening of the installation expenses.—*Ex.*

American Electric and Illuminating Company.

THE FIRST MEDAL OF CINCINNATI EXPOSITION AWARDED TO THEIR SYSTEM—REMOVAL OF OFFICES—OTHER INTERESTING FACTS.

Frequently during the last six months we have mentioned the prominent events that have marked the progress of the American Electric and Illuminating Co. of Boston. To the ELECTRICAL REVIEW must be given the credit of first bringing this company and its work before the readers of electrical newspapers in this country. In their early struggle for a foothold among other electrical enterprises of similar character their progress was necessarily slow. Mastering the situation Mr. Edward H. Goff soon had his company started on the road to success. Never, under the most intense strain of competition or vilifying comment of jealous rivals, losing sight of the public demand for a good electric light, and one that could be run upon economical basis, it was no near-sighted policy that prompted Mr. Goff to select and test the system which he finally adopted and the one used by the company with such eminent success. With like care every movement was made and each stone of the structure from the foundation up, laid one upon another with attentive forethought, upon broad-gauge principles. It would be an extreme oversight if we did not chronicle some of the events that mark the progressive steps of this company from its obscure position of a year ago to the commanding position it now occupies among the great electrical enterprises of New England to-day, and we take this occasion to speak of two events of recent occurrence, and at the same time give a brief mention of others, for the information of our readers. The most prominent of the former took place in the Cincinnati Exposition at Cincinnati, Ohio, a few days since, when the Thomson-Houston Electric Light was awarded the first prize for the best system of arc lighting. From all other competitors the New England Company had taken the first medal after exhaustive tests had been made by a thoroughly capable and competent jury, and this fact confirms the judgment of Mr. Goff when he chose the Thomson-Houston system as a basis upon which to build a reputation not alone for his own company, but for the excellent system of lighting which he has done so much to promote and extend.

In our issue of June 14 we gave an extended account of this system, which consists, briefly stated, of the ordinary sizes of dynamo machines for generating the current; a simple and easily regulated lamp; and a regulator that adjusts the current to the required quantity automatically at all times and under all circumstances. The inventors have displayed unusual skill in the construction of all their machinery, and have combined the elements of simplicity with good electrical laws, and produced a system that more than justifies the opinions we have expressed, and which have been corroborated by the award mentioned above. In the light of these facts, Mr. Goff has shown commendable business ability in taking a system that combines all the best elements of electric lighting.

The second event we wish to chronicle is the removal of the American Electric and Illuminating Company from their old head quarters at 28 School street to new and elegantly appointed offices at 234 Devonshire street, on Winthrop square, Boston. The removal from inadequate and contracted quarters was a forestalled conclusion for some months past, and its timely occurrence places the company, whose business has outgrown the limited room formerly occupied, in a more favorable position to handle the daily increase of work made necessary by the extension of their system into new localities, and to readily supply the growing demand for machinery and supplies to their numerous plants already in operation.

In the basement of the new building the company have ample room for the storage of materials used in constructing their stations and running lines, &c., and also have reserved a portion of the space for repairing and testing the machinery and lamps. All this portion of the business has formerly been done at some disadvantage, but the new arrangement will bring this essential department under the eyes of the managers, and secure, if possible, better results than were attained before.

The offices on the first floor are conveniently arranged and tastefully fitted up. To the right on entering is the main office, with its most conspicuous occupant, Treasurer H. E. Irvine, and a corps of able assistants. In the further end of the room President Goff sits in a neat office, calm and collected, but ever on the alert to open a new campaign in some favorable locality, and by energetic efforts add another victory to the many already won.

On the left are the offices of the Merchants' Electric Light and Power Company. Here President Wm. A. Hovey presides over the destinies of one of the most successful local electric light companies in the East. The latter company, it will be remembered, purchased the contracts, lines, machinery, and other property of the American Electric and Illuminating Company's initial plant in Boston, and organized with a capital of $300,000 in shares of $10 each. At a meeting on October 3, the directors passed the following resolutions:

Resolved, That in view of the large increase in the company's business, which practically assures larger earnings upon its capital stock than anticipated when the company began business, this board reserves the right either to withdraw the stock from the market altogether, or to advance its price, after giving due notice thereof.

It was then voted to advance the price of the treasury stock from $10 to $12.50 per share after Saturday, October 13, 1883, and notice given to that effect. The price of their stocks have advanced in consequence of this action, and are selling quite up to that price now.

The history of this plant will give an idea of the progress made by this unequaled system of arc lighting, and will be of interest at this time. When it first came into possession of the American Electric and Illuminating Company, about one year ago, there was scarcely 200 lamps in circuit. During the fall and winter this figure was run up to 400, and when the parent company sold its rights to the Merchant Electric Light and Power Company, it numbered 550. There are now orders for over 150 more lights upon the books of the latter, who are now getting good rates for furnishing 250 lights to illuminate the New England Institute Exposition, and for 125 lights at the World's Fair, in Boston.

The increase of business as shown by the records of the American Electric and Illuminating Company are substantial and exceedingly encouraging, and when fully carried out will provide New England with more and better electric lights than any other section of the United States.

The Hartford Company have been running a plant of 50 lights, and at a meeting of the local directors last week, passed resolutions ordering 150 additional, making 250 lights fully equipped.

The erection of a 200 light plant at Worcester, Mass., and the completion of a similar one at Providence, R. I.; the addition of 50 lights to the Lowell companies' 150, and an order for 100 to be shipped at once, are gratifying events.

The Wachusett Electric Light Co., of Fitchburg, Mass., have an exceedingly capable management, and include among its directors the following prominent business men of that place: O. H. Lawrence, President Wachusett National Bank; George E. Clifford, Cashier; James L. Chapman, Treasurer Fitchburg Machine Works; L. J. Brown, Director Wachusett National Bank; Walter A. Fairbanks, Director Wachusett National Bank.

This company are forming a syndicate for promoting the electric light, and propose to erect central stations at Leominster, Gardner, Clinton, Marlboro, North Adams and Greenfield, Mass., and at Keene, N. H. To do this work in the usual complete manner, it will require over 500 lamps and equipments.

The Portland (Maine) Company will soon add 125 lights to the 75 already in operation, and are laying their plans to build plants in fifteen cities and towns in their State. The company is entertaining a proposition to light the cities of Biddeford and Saco, Maine, and will doubtless put in a plant of 200 lights.

With this remarkable showing of prosperity, the opening of the season, when illumination of all descriptions are the most lucrative, and the energetic efforts of President Goff behind all, we do not hesitate to pronounce for the American Electric and Illuminating Company a continuance of its phenomenal success

The Electric Light.

SOME FACTS REGARDING THE BRUSH SYSTEM.

It is superfluous for a writer to say much in favor of the electric light, its superior advantages are already so well known. Over the entire country it is used to a great extent, and is the best artificial light known to civilization. Many companies have been organized and spent considerable money in experimenting upon the different systems of distribution.

The Brush system is controlled on the Pacific coast, California, Oregon, Washington Territory, Nevada, etc., by the California Electric Light Company, whose works and offices are located at 220 to 226 Jessie street, San Francisco. It was incorporated in June, 1879, and commenced furnishing lights in September of the same year and is now running about 300 arc lights for stores and outside spaces in San Francisco. The company was the first in the world to furnish lights with power controlled from a central station. Heretofore they have been furnishing only the arc lights, it being impracticable to run incandescent lights direct from the dynamo machine, there being so much loss in distribution. The perfection of the Brush storage battery, however, renders the furnishing of incandescent lights a complete commercial success and as perfect an illumination for domestic purposes as the large arc light for outside illumination. This company has met with so much success in furnishing lights from the arc system that they have of late added new machinery to their works in order to meet the increased call for arc lights as well as to meet the assured demand for incandescent lights as soon as the company is able to furnish them, which is expected in a few months. They are are only waiting for the Brush Works at Cleveland to turn out the batteries, which is being done at the rate of 3,000 incandescent lights daily.

The cities of San Jose and Los Angeles are lighted by the Brush Electric Light under contract and other places of more or less importance are in negotiation for this system.

A new electrical company has just been organized in Boston by some of the most prominent capitalists in that field. It will be known as the Domestic Electrical Manufacturing Company, and will manufacture electrical specialties and novelties of all kinds. The gentlemen interested in it are all representative men; they own many valuable patents on specialties in this line which will be brought out at once.

The Crossley Telephone in Calcutta.

Our special correspondent informs us of the projected establishment of a new system of telephonic communication in Calcutta and the suburbs. The project is that of the Crossley Telephone Company of London, who, having succeeded in, we believe, three or four of the large towns of the province, where other parties had previously failed, now seem confident that there is further scope for their operations in the capital. One of the company's leading directors is Mr. Louis J. Crossley, the head of the well-known company of carpet manufacturers in Halifax, Yorkshire. The Crossley Telephone Company have been remarkably successful on the continent of Europe and throughout the Australian colonies, where, it is stated, the Crossley form of apparatus has beaten, and to a large extent superseded, that of its rivals.

The chief merit of the Crossley apparatus is stated to lie in the "transmitter," which being non-adjustable, cannot get out of adjustment, or, in other words, cannot get out of order, except from the breaking of one of the parts, which cannot well happen with anything like fair usage. As an opportunity of testing its merits will be afforded to the public in a few days, we may at present abstain from general description; but what is broadly claimed by the company—and upon this will rest their principal claim to support here—is that users of the Crossley system are practically free from the perpetually recurring annoyances of delays, over-hearing, and inability to hear it all. The company undertake to supply to their subscribers a constant, distinct, and private service, and, assuming this to be so, their present effort will receive general sympathy in Calcutta.

We notice that only "about one-half of existing rates" will be charged, which is an important reduction. The Company will start fair and free, unfettered by any burden of unproductive capital, paid in respect of good will or patent rights; and in this manner they obviously occupy a very advantageous position, enabling them to conduct their business in a much more economical manner than a company not similarly free.

Many improvements in the construction of the instruments, suggested by an investigation of the causes of the hitherto imperfect telephonic communications in India, have been introduced into the apparatus for use in this country, both as regards workmanship and materials. What would do for more temperate parts has been found unsuited to our peculiarly variable climate. Every Crossley telephone, therefore, that is sent to Calcutta will be put together with special regard to local requirements. Although the exchange system has not in India obtained the success which has attended it almost universally elsewhere, the Crossley Company are confident, from their experience in other quarters, that a well-conducted service, affording to its subscribers facilities real and reliable, will yet take root.

A telegraph line has been opened between Huimaquillo and San Juan Bautista, Tabasco, Mexico.

August, 1883.

Editor Electrical Review:

Zurich *is* a fine place to stop in, though there are other places in Switzerland I should prefer for a prolonged stay—that is, for summering. As a town, Zurich is at the top of them, but it is a place of only 70,000 people or so.

Altogether it is a country one would like to live in. You can choose your own climate at any time of the year. In the summer you can be amid snow and ice in a few hours, and in the winter you can be in sunny Italy in half a day. Living is cheap and good, and the people are pretty fair on the whole.

It is the only country in Europe where they have gone to work systematically and imitated all the best American telephonic and telegraphic instruments. They know enough not to invent anything of their own; they simply imitate, and do it fairly well.

While we have been in Switzerland we climbed a huge old mountain near Luzerne called Pilatus. It is some 5,600 feet above the lake and 7,000 above the sea. The ladies in the party had a horse between them, and took turns riding.

I have read of people climbing mountains, but I never appreciated what a fearful job it is. We were 5½ hours getting to the top of that beastly old hill, and when we got there we were ready to drop. We found ourselves among the clouds, and it began to rain and snow, and we couldn't see ten rods in any direction. But there was a comfortable hotel there, for a mountain top, where everything has to be backed up, even to firewood, and we ate some good beefsteaks and rested the whole afternoon. The bad weather continued, and we thought we might as well stick it out. So we went to bed and slept like logs.

I happened to wake up about half-past four, and saw a streak of sunlight in the room. We got out in a hurry, climbed to the top of the mountain, and had the finest view that ever was seen in this world of sin and sorrow. We had the fun of wading through snow-banks and climbing icy paths in the middle of summer. There was a big snow-bank in front of the house when we got our breakfast.

There is no use trying to describe the view. We had a splendid sight of the whole range of the Alps, and all Switzerland lay at our feet and around us, with no end of lakes and hills and valleys and rivers. It was worth the climb.

We found, however, that the descent was in some respects worse than the ascent. We had the whole distance to make at a stretch, and no horse, as we had sent away our animal and chosen a different path to go down. The party was visibly tired before we had made half the distance. The last half was the worst, too. It was through woods, zigzagging in the genuine Alpine fashion down an almost perpendicular height. I never knew that mountains were such horribly wet and muddy things, but we found this to be so in fact. The paths are either mud or rough gravel, and it rains three-fourths of the time. The rain overtook us again, and we had a rough time of it.

When we reached the bottom we were all so tired we could hardly stand. We got a boat to Luzerne, and the next day we were all too lame to do anything. It was laughable to see one of the party try to go down stairs.

While I have been in Switzerland I have got no news about what was going on in the world. I happened to pick up a Swiss paper, and noticed that the "Telegraphistenstrike" in America was spreading. That was the first I had heard of it. I always find out things from American papers, even about European affairs, that I could never get from papers here. S.

The meetings of the New York Electrical Society were resumed Friday evening, Oct. 5th, after an adjournment through the summer months.

President Small made a few appropriate remarks on the death of Professor Varley, the eminent English electrician, and appointed a committee to draft suitable resolutions thereon.

The subject of the evening's lecture was, "The Use of the Electric Light in Artistic Photography, Illustrated by Diagrams and Specimens of the Results," by Prof. P. H. Van der Weyde.

After a few preliminary remarks, the Professor began his lecture by explaining, with the aid of diagrams, how the rays from the electric light were diffused in every direction, decreasing in intensity with the square of the distance. The only difference between the light of the sun and the electric light was in the degree of intensity. The electric light, as it is seen on our streets, is too weak for photographic purposes. Could all of the rays be concentrated upon the sitter, or object to be photographed, then we would approach nearer the character of sunlight. This has been accomplished by means of parabolic reflectors and Fresnel lenses. The reflectors, with the light at its axis, transmits the rays in a straight line, and are passed through Fresnel lenses, which concentrate the rays upon the sitter. The results by this system have been entirely successful.

The speaker then passed around among the members several photographs of prominent persons in English society, taken by his son in London, by means of the above described method.

Several gentlemen in the audience, competent to judge of their merits, pronounced the pictures as evidencing a high degree of artistic finish, and equaled, at least, the best production of the ordinary method of photography. This new method of photography, which is the invention of the Professor's son, is particularly suited to London, where sun light is almost constantly obscured by reason of the smoke-laden atmosphere, and where photographers count on only two or three favorable days, on an average, out of a week.

An establishment in this city has recently adapted the electric light to photographic purposes in a manner similar to the one above described, and with excellent results. So now, it has come to pass that we have a good substitute for sunlight, and can be photographed at any time, day or night, rain or shine.

The professor made a few supplemental remarks concerning the cheap production of electricity of to-day compared with its cost when batteries were used for that purpose. One pound of coal produced as much electrical energy as five pounds of zinc, and since zinc is much more expensive than coal, an approximate idea of the relative cost of producing electrical energy by the two methods may be adduced.

In conclusion, the speaker predicted that the turbine wheel would be the most satisfactory means of driving dynamo machines where water-power could be obtained.

A unanimous vote of thanks was then tendered the professor for his instructive and interesting lecture, after which the meeting adjourned.

The next regular meeting will be held Friday evening, October 19th, at 8 o'clock.

The Society is in a prosperous condition generally. No fewer than eleven names were proposed at last meeting.

The circulating library is in full operation, and members are availing themselves of its advantages.

The Cincinnati Award.

The Thomson-Houston Electric Company, of Boston, have received the first prize for the best arc system of electric lighting, and for the best arc lamps. This verdict of an impartial jury confirms the opinion expressed six months ago in our columns, and, since we have spoken of ourselves, let it be added that the ELECTRICAL REVIEW was *the first electrical paper* that mentioned this excellent system of arc lighting, a fact like many others that should not be forgotten in this forgetful age. This instance is the first in which the Thomson-Houston light has come in competition with other systems of lighting at an Exposition of this magnitude, and to score such a signal victory is indeed remarkable.

Telephone Stock Quotations.

American Bell Telephone Company	235
Bay State Telephone Company	123
Central New York Telephone and Telegraph Company	101
Boston and Northern Telephone Company	135
Empire State Telephone and Telegraph Company	203
Granite State Telephone Company	95
Hudson River Telephone and Telegraph Company	110
Long Island and New Jersey Telephone Company	100
Mexican Telephone Company	2½
National Bell Telephone Company of Maine	90
New York and Pennsylvania Telephone Company	100
Northwestern Telephone Company	100
Southwestern Telephone Company	68
Suburban Telephone Company	139
Southern Bell Telephone and Telegraph Company	125
Tropical Telephone Company	3
Central Union Telephone Company	100
Iowa Union " "	100
Missouri and Kansas Telephone Co.	90
United Telephone Company (Kansas and Missouri)	89
Bell Telephone Company, of Missouri	165
Wisconsin Telephone Company	125
Cumberland Telephone Company	100
Great Southern Telephone Company	100
Michigan Telephone Company	115
Chicago Telephone Company	290
Erie Telephone Company	59

NEW PATENTS—ELECTRICAL—1883.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING OCTOBER 2, 1883.

285,778—Electric switch; Wellington Adams, St. Louis, Mo., assignor to the Adams Electric Company, same place.

285,784—Globe for incandescent electric lamps; George P. Bartlett, Woburn, Mass.

285,799—Magneto-electric generator; Mahlon S. Conly, Indianapolis, Ind., assignor of one-half to William M. Cronyn, same place.

285,807—Planté's secondary battery; St. George Lane Fox, London, England.

285,852—Electric galvanic mattress; Rickason Stillwell, New York, N. Y., assignor by direct and mesne assignments to Bradford Willard and Emeline C. Stillwell, both of same place.

285,853—Means for applying electrical or galvanic currents to beds, couches, &c.; Rickason Stillwell, New York, N. Y., assignor by direct and mesne assignments to Bradford Willard and Emeline C. Stillwell, both of same place.

285,854—Electric mattress spread; Rickason Stillwell, New York, N. Y., assignor by direct and mesne assignments to Bradford Willard and Emeline C. Stillwell, both of same place.

285,857—Electric motor; Charles J. Van Depoele, Chicago, Ill.

285,858—Electric railway; Charles J. Van Depoele, Chicago, Ill.

285,859—Automatic electric circuit-changer; Chas. J. Van Depoele, Chicago, Ill.

285,944—Automatic electrical-railway signal; Daniel H. Applegate, Red Bank, N. J.

285,977—Electro-medical appliance; James W. Dennis, Cincinnati, O., assignor to Clara E. Dennis, same place.

285,983—Fire alarm; Robert S. Finch, Cincinnati, Ohio.

286,086—Electrical conductor for oil tanks; Henry W. Spang, Reading, Pa.

286,093—Electric lamp; Charles J. Van Depoele, Chicago, Ill.

286,094—Electric arc lamp; Chas. J. Van Depoele, Chicago, Ill.

286,107—Telegraphic repeater; William E. Athearn, Philadelphia, Pa.

286,144—Electric arc lamp; Richard R. Moffatt, Brooklyn, N. Y.

286,158—Electric cut-off; John H. Tupper, Salt Lake City, Utah.

The ELECTRICAL REVIEW, published in New York, by Delano & Co., 23 Park Row, comes to us weekly among our exchanges. It is well illustrated, and upon all matters electrical and scientific it may be considered the best authority of any journal of the kind in the electrical field. Besides being very ably edited, its corps of contributors, (who are representative men in that field) located in almost every important business center in this country and Europe, give a peculiar interest and value not found in other papers of this class.—*Chester County Times.*

Manufacturing News.

The Coe Brass Works at Torrington, Conn., are well fitted to supply the trade with sheet and rod brass, copper wire of all sizes, and zinc rods for battery purposes. The latter are drawn in all the standard forms ready for cutting up and adjusting to any style of battery, or drawn in such shape as the consumer desires. They do a large proportion of the business of the country in zinc rods for telephone batteries, and they claim to make a more uniform article than any other house in the business, on account of their superior process and the excellent quality of the material they put into their rods.

A telephone line has been started in Parral, Chihuahua, Mexico.

The Bishop Gutta Percha Works are very busy at present on heavy orders for telegraph and telephone cables.

The telegraph line between Culiacan and Altata has suffered considerably on account of the heavy rains that have visited that section.

The telephone company of Leon, Mexico has recently placed a telephone in the depot of Central Railroad for the benefit of passengers.

The Minneapolis Northwestern Miller estimates that the present daily production of flour from the mills at that city is 26,660 barrels, against 21,250 barrels daily one year ago, an excess of 5,410 barrels.

Bridgeport is considering the question of adopting the Brush-Swan system of electric lighting for the city streets, and will send a committee to Willimantic on Wednesday to inspect the workings of the system.

The dynamo-machines used by the United States Electric Light Company have taken the first prize at the Cincinnati Exposition. They are of the Weston type, and are very beautiful and symetrical machines.

The electric clocks in Paris number fifteen. Seven are upon one circuit and eight upon another. But their working is not quite satisfactory. During the past year they have gone out of order from various causes and lost as much as two seconds from the effect of the vibrations of the streets upon the regulators.

Another test of the Wooley electric locomotive headlight was made recently at the Gilliland Electrical Works. Since the test mentioned in the *Journal* some thirty days since, at the bolt works, several minor improvements have been made which still nearer perfects its operations, and the invention now promises to be a perfect success. In the experimenting last night the numbers on freight cars standing on a side-track one-third of a mile distant could be seen distinctly, and on windows twice that distance the reflection was brilliant. General Manager Malott has consented to the testing of one of these lights on the Belt road, and a company has been organized to introduce the light. Numerous letters of inquiry as regards the light have already been received.—*Ex.*

BUSINESS NOTICES.

SITUATION WANTED—By a young lady in a telephone exchange; has had three years' experience in the business, and is thoroughly well posted. Address Lock Box 22, Schoharie, N. Y.

FOR SALE—United States and Canadian rights in an arc lamp; inventor desires to sell his patents outright for a moderate sum. Address "Arc Lamp," P. O. Box 3329, New York City.

A mechanical and electrical engineer, graduate of the United States Naval Academy, desires an engagement; highest testimonials. Address G. S., 25 Bowdoin street, Boston, Mass.

There were, in round numbers, about 14,500,000 people in Spain and its belongings at the last record. Of the 6,600,000 were in Spain itself, and 5,500,000 in the Phillipines. 1,500,000 in Cuba, and about 750,000 in Porto Rico.

In the year 1872 the consumption of copper in the United States was 34,000,000 pounds, and since that time it has steadily increased. Last year it was 77,000,000.

The amount of cotton seed produced in the United States annually is placed at 170,000,000 bushels, and the average price thirteen cents per bushel, equal to $22,000,000.

It is announced that the Sharps Rifle Factory at Bridgeport, Ct., will soon be occupied by a company having a pay roll of $12,000 a month.

The knot or nautical mile is variously reckoned at from 6,076 feet to 6,125 feet. According to the standard of the British Admiralty the knot is the length of one minute of longitude at the equator, or 6,086 feet 1.1527 statute inches, or 1,855 meters. The mean length of latitude, sometimes reckoned as a knot, is 6,076 feet 1.151 statue mile, or 1852 meters. A marine league is three of these sea miles.

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Attorneys in Patent Causes And Solicitors,
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CHARLES E. FOSTER.
RANK L. FREEMAN, { Late Examiner in charge of Class Electricity / Patent Office.
FOSTER & FREEMAN,
SOLICITORS OF PATENTS AND COUNSELORS IN PATENT CAUSES,
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OFFICES: 931 F STREET.

The Wright Patent Cable Clip.
This is the most economical and easily-applied device for suspending aerial cables. It is very light and strong, and will not rust. The clip is used extensively, and is highly recommended by the management of the Boston, Providence, Washington, and other telephone companies in this country and Canada. The gain in time of workmen in putting up cables will save more than the cost.
The Howard Safety Appliance (Patented.)
This device comprises a lightning arrester, cut out, and fusible wire, in a compact form, to be placed outside of the house or place of business of the subscriber; the electric current, by means of an arm extending inside of the building, being entirely cut off from the interior at the will of the subscriber, while fusible wires afford additional protection when the instrument is in circuit should an excessive charge, as from electric light currents, be accidentally thrown upon the telephone line. The advantages of this device are too obvious to need further comment. It is in successful use in Providence and other exchanges, and is in increasing demand wherever it has been introduced.
The Breckenridge Jack (Patented.)
This is a device for looping in the Central Office telephone without breaking circuit, or in any way interfering with the free conversation of subscribers who may be using the line. The central telephone office in Providence has used this device in preference to all others. Two years' experience has proved its perfect reliability and adaptation to any of the wants, in this respect, of a large telephone exchange. It is in use in some fifteen or twenty exchanges in the country, and is recommended by all who are familiar with it.
The Providence Switchboard (Patented.)
This is the new style of switchboard, invented by Mr. Breckenridge, of the Providence company, which is used exclusively in the Providence central office, where there are over eighteen hundred subscribers' lines in one room. It admits of expansion to accommodate at least three thousand subscribers' lines in one room. It is the most compact switchboard of its kind yet invented. It brings all the working parts within reach of the operator without stretching, and, all the connecting wires and points being encased in rubber, has practically no leakage or induction. It has been found indispensable to quick and economical work in a large central office. It is the only switch which can be used advantageously for metallic circuits. The Worcester office has been equipped with this board, and switches for Springfield office are now being made. Every large exchange should examine this switchboard thoroughly before making a choice in this respect.
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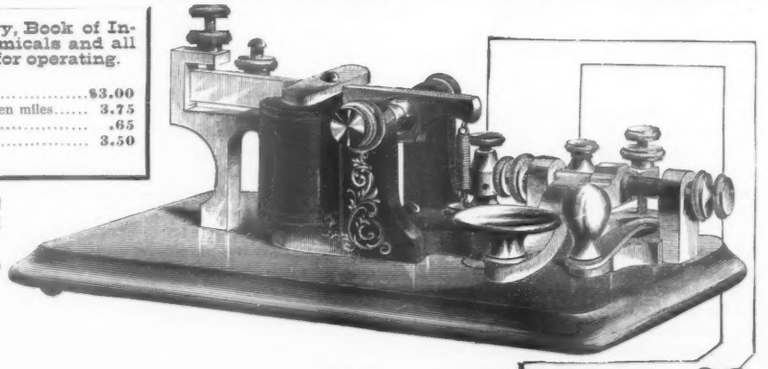

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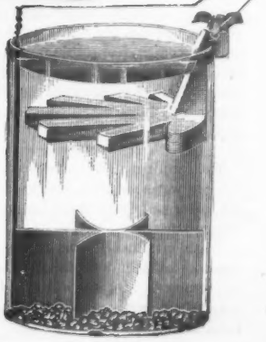

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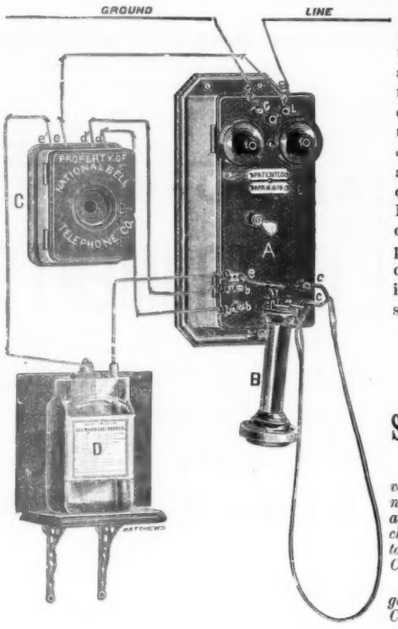

This Company owns the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents, covering improvements upon the same, and controls, except for certain limited territory, under an arrangement with the Western Union Telegraph Co., the Gold and Stock Telegraph Co., the American Speaking Telephone Co., and the Harmonic Telegraph Co., the Patents owned by those Companies, and is prepared to furnish telephones to the citizens of the United States through its local Licensees, on the following systems:

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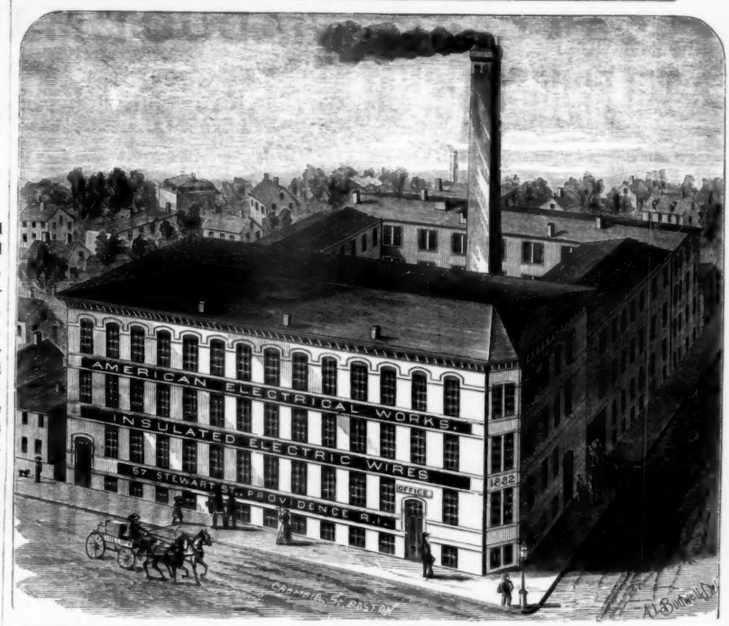

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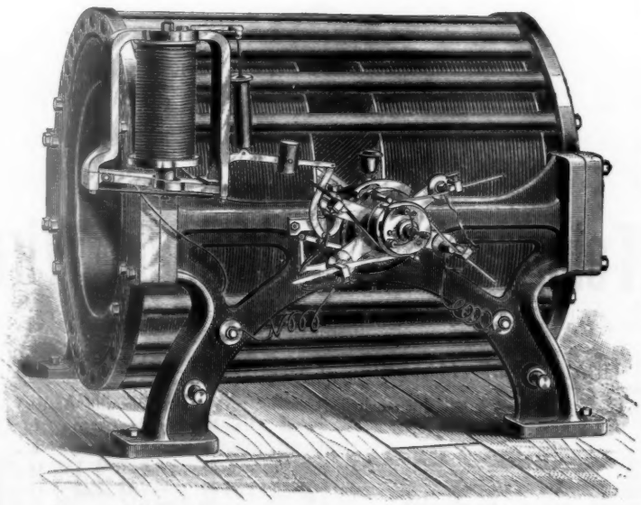

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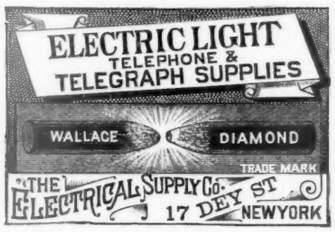

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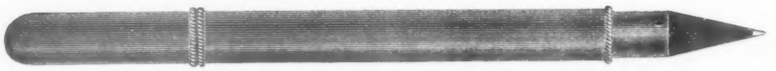
$1.00  $1.00

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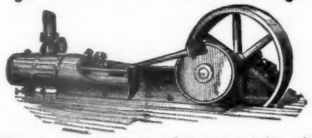

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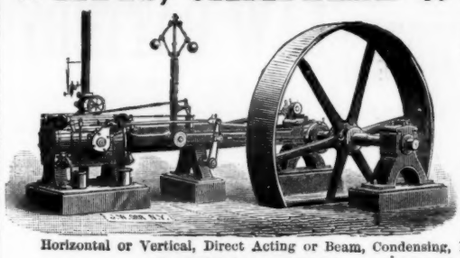

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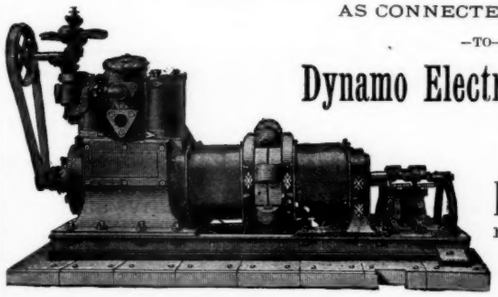

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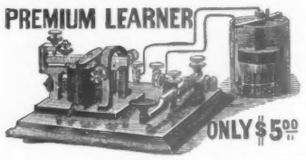

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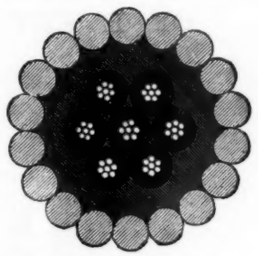

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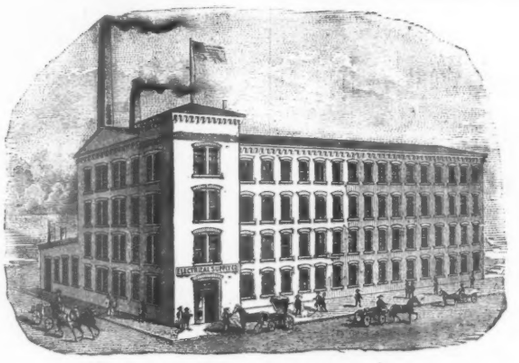

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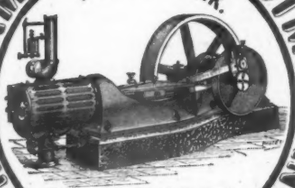

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